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WHALES AND WHALE FOETUSES
STATISTICS OF CATCH AND MEASUREMENTS COLLECTED FROM THE NORWEGIAN WHALERS' ASSOCIATION 1922—25

BY

SIGURD RISTING
SECRETARY OF THE NORWEGIAN WHALERS' ASSOCIATION

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ANDR. FRED. HØST & FILS
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PREFATORY NOTE

This Report by Mr. S. Risting was kindly prepared by him to form part of a composite report on Whales and Plankton which the International Council for the Exploration of the Sea has in preparation. Unfortunately, unavoidable delay has occurred in the preparation of certain chapters of the contemplated report which makes it impossible for that report to be published this year.

The Bureau, therefore, has decided that Mr. Risting's report should be published separately, in advance, in order that the statistical information contained in it may at once be available to the public. It is, however, to be regarded as an instalment of the larger report, which it is hoped will be published early next year.

November 22nd, 1928.

Henry G. Maurice.

WHALES AND WHALE FOETUSES

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PREFACE

During the many years in which I have worked at the collection of Statistics regarding whaling it became more and more desirable for me to gather as much material as possible regarding measurements of whales and foetuses in order, if possible, thereby to throw light on certain conditions respecting the life and migrations of whales.

When in 1919 I became Secretary of the Norwegian Whalers' Association I began to prepare this work and the members of the Association gave their support to the plan.

During the first years the material obtained was scanty, but after 1922 almost all Norwegian whaling companies and a number of foreign ones began to contribute that kind of material to the Whalers' Association.

The material rapidly increased and I then began to plan its preparation, since I had previously, to no slight extent, published a preliminary account in the organ of the Whalers' Association "The Norwegian Whaling Gazette".

I conferred several times with Professor JOHAN HJORT regarding the matter and from the first he displayed great interest in the work; he gave me much advice and encouragement and also discussed the plan for the publication of the material.

Dr. HJORT advised me to apply to Director FR. LANGE-NIELSEN in order to have calculated the measurements which would have to be taken into account in calculating the average size of the whale fetus, and subsequently he endeavoured in every way to support and facilitate my work. In venturing to submit a number of results I should like to thank all those who in the course of years have assisted me by collecting the necessary material.

In particular I would offer my special thanks to Professor JOHAN HJORT for the support and help he has given me during the preparation of my material, and finally I would express my thanks to Director FR. LANGE-NIELSEN for his great work with a number of calculations connected with the present treatise.

I trust that my work may be regarded as an attempt to contribute towards our knowledge of the conditions of life and the migrations of whales.

Trollhaug, near Sandefjord, June, 1927.

SIGURD RISTING.

I.

Subjects under consideration.

In the autumn of 1919, as Secretary of the Norwegian Whalers' Association, I requested a number of whaling directors to undertake measurements of whales and their fetuses in the whaling fields of the Southern Seas. In this connection a schedule was sent with the expeditions upon which answers were requested to the following questions:—

1) When and where was the animal captured?
2) Species of whale.
3) Length, measured in a straight line from the point of the snout to the end of the tail between the tail fins.
4) Contents of the stomach.
5) Sex of the whale.
6) In the case of a female whale, was the animal pregnant?
7) In the case of a female whale, was the animal accompanied by young ones?
8) Length of the fetus.
9) Possible remarks.

I was aware that formerly from various quarters there had occasionally been sent similar schedules with the expeditions, but the Norwegian Whalers' Association had not received reports of that character, and I considered it very desirable that the Association should undertake something which might throw light on the occurrence and conditions of life of the whale.

In the Spring of 1920 the Whalers' Association received the first measurement return in accordance with these schedules. It was received from A/S "Sydhavets" Expedition to South Shetlands in the season 1919 to 1920.

The following year the Whalers' Association received a similar return from the "Tönsberg Hvalfangeri" for the catch off South Georgia in the season 1920—1921. A similar return was sent by the same company for the season 1921—1922. The measurements sent in were given a preliminary examination and I published the result in the Norwegian Whaling Gazette (Norsk Hvalfangsttidende).

For the season 1922—1923 there were sent measurement statistics from the following companies:—

South Georgia:	Tönsberg Whaling Company.
	Bryde and Dahls Whaling Company.
South Shetlands:	A/S "Hektor"
	A/S "Hvalen"
	A/S "Odd"
	A/S "Norge"
	A/S "Örnen"
	A/S "Sydhavet".

For the season 1923—1924 there was sent a statement from the following companies:—

South Georgia:	Tönsberg Whaling Company.
	Bryde and Dahls Whaling Company.
South Shetlands:	A/S "Hektor"
	A/S "Hvalen"
	A/S "Odd"
	A/S "Norge"
	A/S "Örnen"
	A/S "Sydhavet"
South Orkney:	Tönsberg Whaling Company.

For the season 1924—1925 returns were sent from the same companies as in 1923—1924.

The material contains statistics of measurements for 7,750 blue whales and 6,919 fin whales, i. e. 14,669 measurements of whales. It also contains 1,054 measurements of fetuses. Of the latter 592 were fetuses of blue whales and 462 fetuses of fin whales. Finally, the measurements contain a number of statistics regarding Humpbacks, *Balænoptera borealis*, and Sperm-whale, but as these species now play a quite subordinate part in whaling as a whole, the present work will not contain any account of the conditions of life of these species of whale in the Southern Seas.

For the years 1922—1925 there are further statistics of measurements for practically all Norwegian Whaling Companies outside the Southern Seas, both from tropical waters and from the whaling fields in the Arctic, and these measurements are still continued everywhere where Norwegian companies carry on whaling. A number of foreign companies have also during these years sent similar statistics, and have thereby contributed to a high degree to increase our material and render it comprehensive.

In publishing an account of the material to hand, in spite of the fact that the collection of material still continues, the object is that the statistics to hand must be considered to be sufficiently comprehensive to form the basis of certain conclusions.

The first question which it was desired to elucidate was the periodic appearance of the whale in the fields at South Georgia and South Shetlands.

Does the stay of the whale in those waters vary from year to year, or does it appear there regularly one year after another? Does a large number of the world's stock of whales resort there at a certain time of the year, which year after year falls within a certain period e. g. the same month, or does their first appearance in the whaling fields vary from year to year?

Do the whales on the whole leave those fields at a definite time of the year, or does their disappearance from those waters vary in point of time? Is the quantity of whales in the fields of the Southern Seas practically speaking equally large throughout the whole season, when once the animals have arrived at the field, or is the quantity of a varying character, e. g. from one month to another, so that it must be assumed that new supplies must have arrived.

Are the blue whales and fin whales present in all seasons in somewhat equal quantities mutually?

Do the blue whales and fin whales arrive in the whaling fields practically simultaneously, or does one of these species arrive before the other? Do the two species leave any prescribed whaling field at about the same time, or do a large number of one species remain after the bulk of the other species have already left the whaling field in question?

Finally, are we justified in speaking of a "blue whale year" in contradistinction to a "fin whale year" in one or more whaling fields?

In order, if possible, to throw light on some of these questions the Norwegian Whalers' Association commenced several years ago to collect "whaling statistics" from the various companies all over the world. These statistics were entered on a schedule which gave information regarding every whaling boat, so that a statement was made of the catch of every species of whale (blue whale, fin whale, humpback, sei whale, Bryde whale, right whale and California Grey) in every month of the year.

In the course of years there has been collected a great deal of valuable material. Practically all Norwegian Whaling Companies throughout the world have rendered such returns annually, and in addition a number of foreign companies have kindly helped to increase our material.

By the aid of the statistics thus collected it is now possible to draw "catch curves" for the various fields, and we thereby obtain a picture of the periodic occurrence of whales in the various fields.

An extract of this material has from time to time been published in the Norwegian Whaling Gazette (Norsk Hvalfangsttidende).

II.

Catch Statistics.

As my primary object is to elucidate the conditions as regards the number of whales in the Southern Seas, I will for the time being only include statistical information from South Georgia, South Shetlands and South Orkneys.

Statistical material in accordance with the above mentioned schedule is now available for the years 1919 to 1926, and as it contributes to clearness and insight to deal with each of the large whaling fields separately, I select to begin with

South Georgia.

For the season 1919—1920 there exists material from all the Norwegian companies, which in that season employed in all 9 whaling boats. In the case of the other companies there is only available a statement of the total results of the season's catch. These figures are, therefore, not included. In the case of 5 whaling boats, whaling commenced in the first days of August, whilst the others did not commence operations until November 24th. 6 whaling boats ended operations about May 15th, whilst the others continued somewhat longer. The following table shews the total catch per month of the various species of whale.

Table 1. 1919—1920.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
August	9	4	..	..	..	..	13
September	21	7	..	..	..	..	28
October	8	40	..	..	..	..	48
November	21	44	1	..	2	..	68
December	79	145	12	..	..	..	236
January	174	177	18	..	..	..	369
February	67	131	6	4	..	..	208
March	29	167	1	19	1	2	219
April	7	20	..	9	..	3	39
May	..	2	..	..	..	..	2
Total...	415	737	38	32	3	5	1230

The following curve gives the figures in a graphic form.

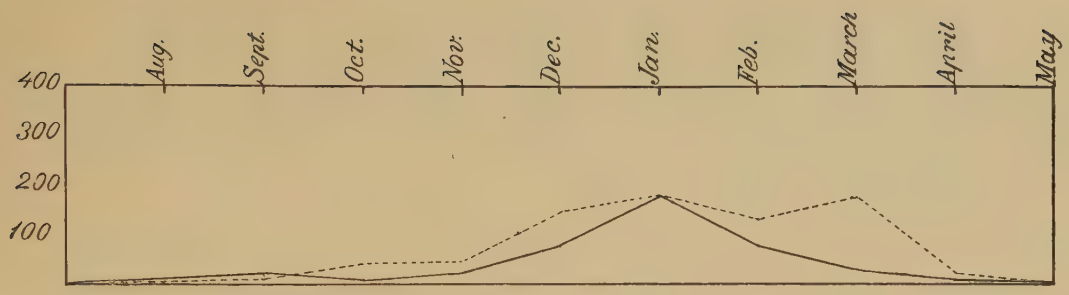

Figure 1. Number of Whales at South Georgia 1919—1920.
———— Blue whales. - - - - - - - Fin whales.

For the season 1920—1921 statistics are available from the two Norwegian companies which then operated from South Georgia, namely "Vestfold" and "Tönsberg Hvalfangeri". They employed in all 8 whaling boats. One company commenced whaling in September, whilst the other did not begin until October 8th. Both companies concluded their activities about the end of the month of May. The following table shews the total catch per month.

Table 2. 1920—1921.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
September	1	11	..	..	..	..	12
October	16	17	..	..	3	..	36
November	28	60	6	..	5	..	99
December	19	86	5	..	1	..	111
January	16	328	12	..	1	1	358
February	41	268	2	1	..	1	313
March	91	163	2	7	5	3	271
April	70	166	9	1	..	1	247
May	37	78	4	..	..	..	119
Total...	319	1177	40	9	15	6	1566

Graphic representation of the results of the catch.

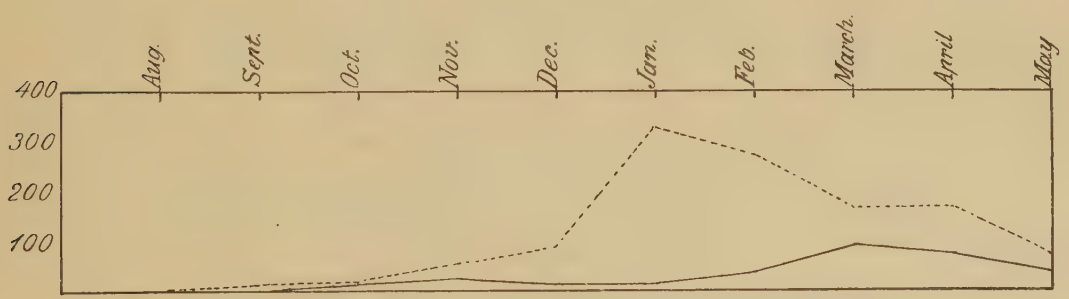

Figure 2. Number of Whales at South Georgia 1920—1921.
———— Blue whales. - - - - - - - Fin whales.

For the season 1921—1922 figures are available for the "Vestfold", "Tönsberg Hvalfangeri" and "Cia Argentina de Pesca", in all 12 whaling boats. Whaling commenced that year at a later date than usual, not beginning until the period November 23rd—December 10th. It ended on May 31st. The following table shews the total catch per month.

Table 3. 1921—1922.

Month	Blue whale	Fin whale	Humpback[1])	Sei whale	Sperm whale	Right whale	Total
November	18	14	..	..	..	..	32
December	174	132	..	..	..	..	306
January	360	82	..	..	..	..	442
February	417	28	..	..	..	..	445
March	237	9	..	1	..	..	247
April	69	31	..	23	..	..	123
May	20	60	..	38	..	..	118
Total...	1295	356	..	62	..	..	1713

Graphic representation of the results of the catch.

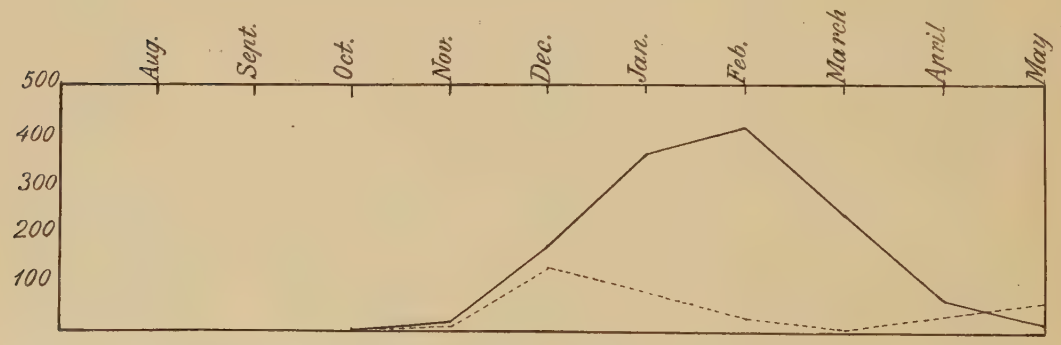

Figure 3. Number of Whales of South Georgia 1921—1922.
———— Blue whales. - - - - - - - Fin whales.

For the season 1922—1923 figures are available for the "Vestfold", "Tönsberg Hvalfangeri" and also "Bryde & Dahls Whaling Company" and "Cia Argentina de Pesca", 15 whaling boats in all. Operations commenced during the period October

[1]) The humpback whale was preserved the whole season.

14th—November 9th, and concluded during the period May 10th—May 31st. The total catch is shewn in the following table:

Table 4. 1922—1923.

Month	Blue whale	Fin whale	Hump-back[1])	Sei whale	Sperm whale	Right whale	Total
October	49	2	..	..	..	..	51
November	296	98	..	..	..	..	394
December	537	146	..	..	..	..	683
January	202	185	248	..	10	..	645
February	281	178	..	3	6	..	468
March	366	171	..	3	..	..	540
April	146	161	..	..	..	..	307
May	35	50	..	..	..	..	85
Total...	1912	991	248	6	16	..	3173

Graphic representation of the results of the catch.

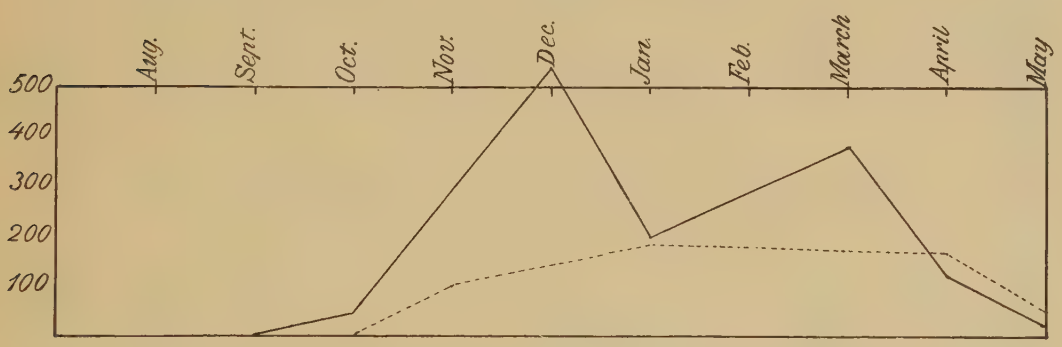

Figure 4. Number of Whales at South Georgia 1922—1923.
———— Blue whales. - - - - - - - Fin whales.

For the season 1923—1924 there are available figures from all the whaling companies on the Island with the exception of "Chr. Salvesen & Company". The statistics thus comprise 19 whaling boats.

Operations commenced during the period October 1st—October 8th, and concluded during the period April 28th—May 13th. The total catch per month is shewn in the following table:

[1]) The humpback whale was preserved except during the month of January.

Table 5. 1923—1924.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
October	110	72	..	..	6	..	188
November	234	140	22	..	3	..	399
December	530	204	36	..	..	..	770
January	383	208	43	..	3	..	637
February	253	210	..	..	9	..	472
March	67	151	..	60	..	..	278
April	49	128	2	93	12	..	284
May	5	25	..	2	2	..	34
Total...	1631	1138	103	155	35	..	3062

Graphic representation of the results of the catch.

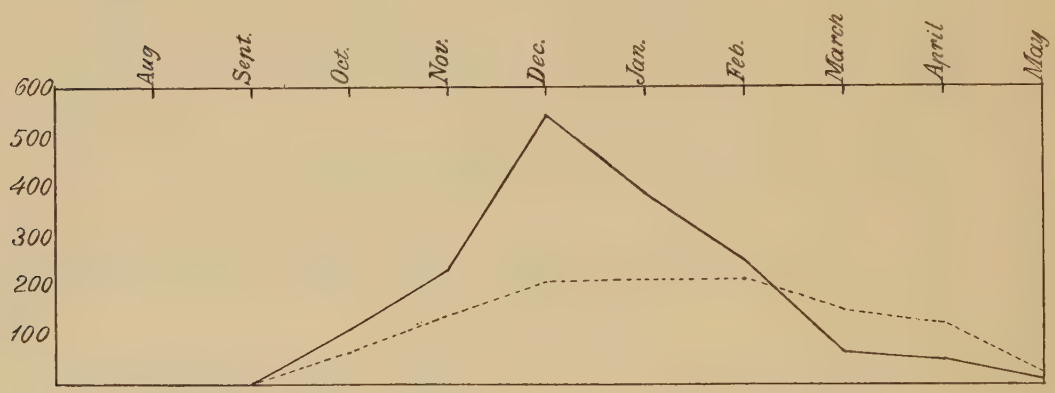

Figure 5. Number of Whales at South Georgia 1923—1924.
———— Blue whales. - - - - - - - Fin whales.

For the season 1924—1925 figures are available for all the Norwegian companies and in addition for "Cia Argentina de Pesca", 15 whaling boats in all. Operations commenced in the period October 2nd—October 12th and concluded in the period May 5th—May 20th. The total catch per month is shewn in the following table:

Table 6. 1924—1925.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
October	142	64	..	..	4	..	210
November	416	124	12	..	..	..	552
December	516	173	44	..	..	..	733
January	244	418	46	..	3	..	711
February	207	214	17	..	5	..	443
March	228	117	3	1	..	..	349
April	173	173	2	..	..	..	348
May	75	46	4	..	..	..	125
Total...	2001	1329	128	1	12	..	3471

Graphic representation of the results of the catch.

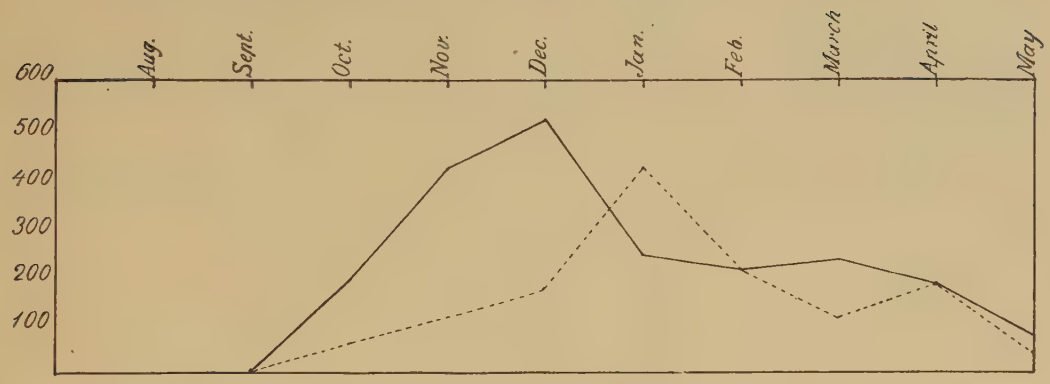

Figure 6. Number of Whales at South Georgia 1924—1925.
———— Blue whales. - - - - - - - Fin whales.

For the season 1925—1926 figures are available for all Norwegian companies and for "Cia Argentina de Pesca", representing in all the catch of 15 boats. Operations commenced during the period September 16th—October 14th and concluded during the period May 1st—May 29th. The total catch per month is shewn in table 7 on page 14.

Graphic representation of the results of the catch.

Figure 7. Number of Whales at South Georgia 1925—1926.
———— Blue whales. - - - - - - - Fin whales.

Table 7. 1925—1926.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
September	12	1	..	..	..	..	13
October	79	69	1	..	1	..	150
November	58	102	7	..	3	..	170
December	71	304	31	..	4	..	410
January	116	836	86	1	3	..	1042
February	278	791	14	3	..	..	1086
March	314	464	1	..	..	..	779
April	158	585	..	1	..	..	744
May	63	287	1	..	..	..	351
Total...	1149	3439	141	5	11	..	4745

South Shetlands.

For the season 1919—1920 figures are available for this field from all the Norwegian companies operating there. The figures comprise in all 15 whaling boats. Operations commenced during the period December 5th—December 7th, although one company did not begin operations until January. Operations concluded during the period March 20th—April 10th. The total catch per month is shewn in the following table:

Table 8. 1919—1920.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
December	253	86	20	..	..	..	359
January	190	554	33	..	2	..	779
February	199	400	16	..	..	..	615
March	156	270	5	..	..	..	431
April	1	13	..	..	..	..	14
Total...	799	1323	74	..	2	..	2198

Graphic representation of the results of the catch.

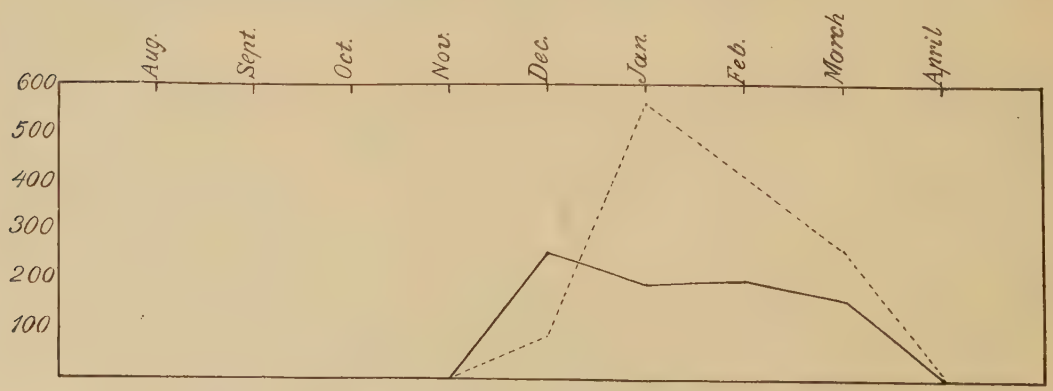

Figure 8. Number of Whales at South Shetlands 1919—1920.
———— Blue whales. - - - - - - - Fin whales.

For the season 1920—1921 figures are available for all Norwegian companies representing in all 23 whaling boats. Operations commenced during the period November 20th—December 3rd, although one company did not commence operations until December 25th. Operations concluded during the period March 4th—March 27th, because the various expeditions were obliged to leave the field owing to the fact that the floating factories had a full cargo. Thus the season could not be entirely utilised.

The total catch per month is shewn in the following table:

Table 9. 1920—1921.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
November	75	13	1	..	..	..	89
December	549	263	23	..	..	..	835
January	671	862	47	..	..	..	1580
February	202	964	20	..	..	..	1186
March	86	399	22	..	..	..	507
Total...	1583	2501	113	..	..	..	4197

Graphic representation of the results of the catch.

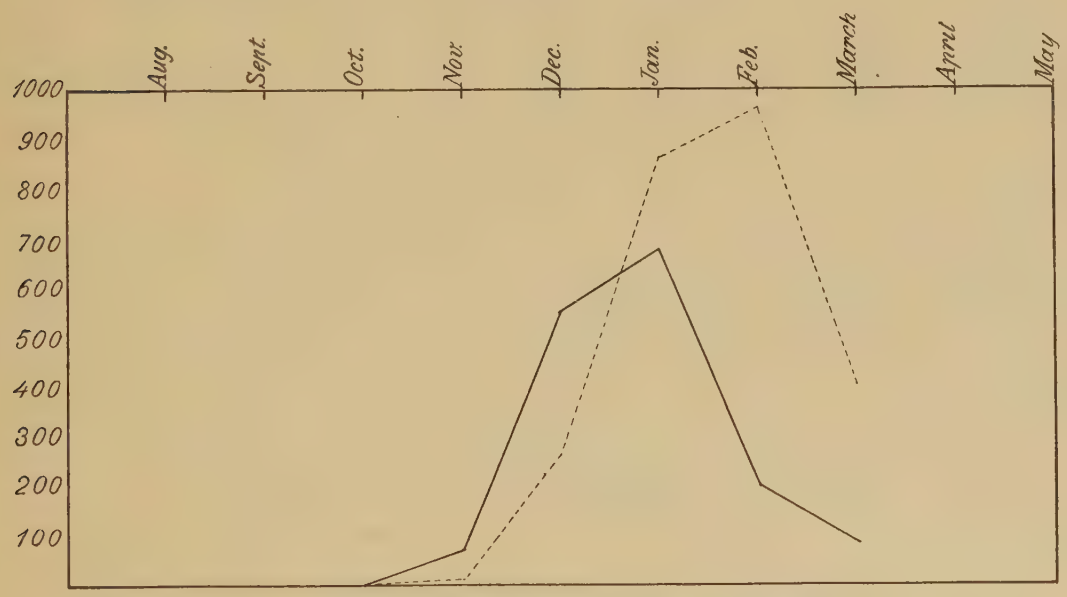

Figure 9. Number of Whales at South Shetlands 1920—1921.
———— Blue whales. - - - - - - - Fin whales.

For the season 1921—1922 figures are available for all the Norwegian companies and in addition for "Chr. Salvesen & Company" representing in all the catch

of 29 boats. Operations commenced during the period November 26th—December 21st and concluded during the period March 28th—April 7th. The total catch per month is shewn in the following table:

Table 10. 1921—1922.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
November	57	..	..	..	..	..	57
December	807	14	..	..	..	..	821
January	644	332	..	..	..	..	976
February	178	487	..	..	..	..	665
March	149	833	..	..	..	..	982
April	11	116	..	..	..	..	127
Total...	1846	1782	..	..	..	..	3628

Graphic representation of the results of the catch.

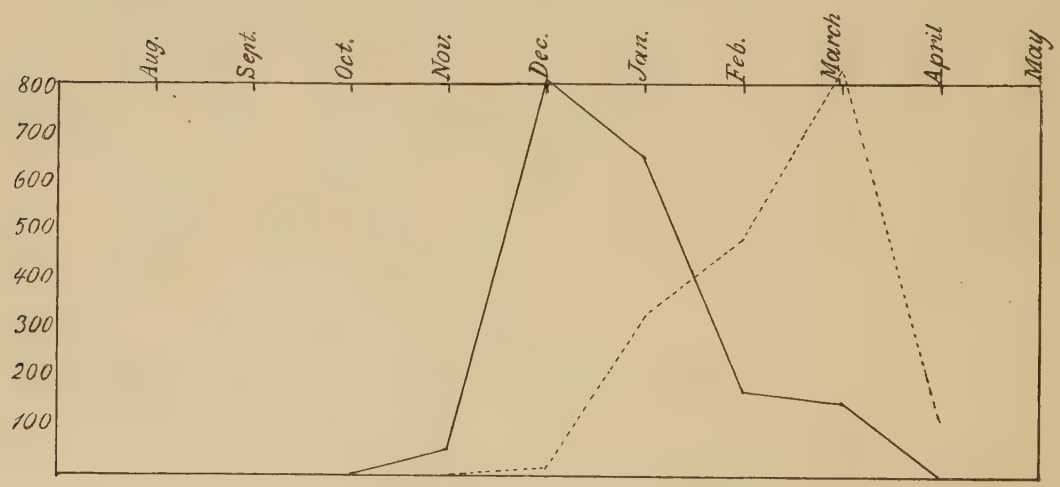

Figure 10. Number of Whales at South Shetlands 1921—1922.
———— Blue whales. - - - - - - - Fin whales.

For the season 1922—1923 figures are available for all the Norwegian companies, representing in all the catch of 26 boats. Operations commenced during the period November 9th—November 25th and concluded during the period April 8th—April 28th.

The total catch per month is shewn in the following table:

Table 11. 1922—1923.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
November	116	2	..	..	..	..	118
December	349	73	14	..	4	..	440
January	432	288	14	..	..	..	734
February	163	318	53	..	..	..	534
March	152	455	55	..	..	..	662
April	169	329	3	..	..	..	501
Total	1381	1465	139	..	4	..	2989

Graphic representation of the results of the catch.

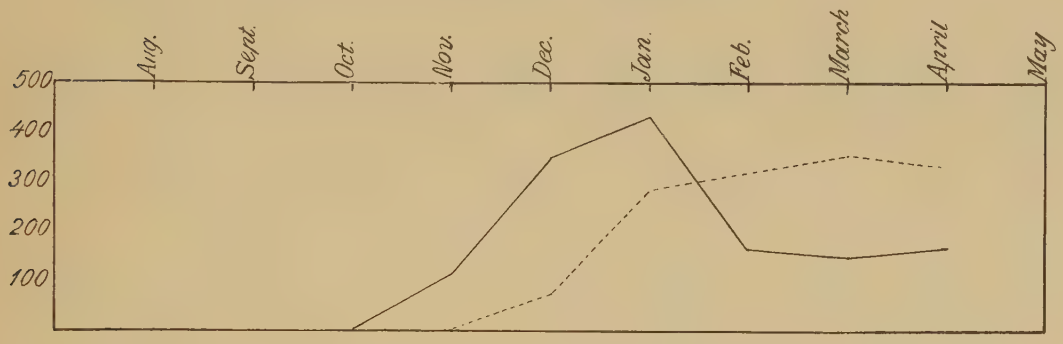

Figure 11. Number of Whales at South Shetlands 1922—1923.
———— Blue whales. - - - - - - - Fin whales.

For the season 1923—1924 statistics are available for all the Norwegian companies and in addition for "the Southern Whaling & Sealing Company", representing the catch of 29 boats in all. Operations commenced during the period November 3rd—November 19th and concluded during the period April 12th—April 20th. The total catch per month is shewn in the following table:

Table 12. 1923—1924.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
November	165	4	..	..	2	..	171
December	496	135	3	..	4	..	638
January	350	330	41	..	..	..	721
February	102	504	30	..	1	1	638
March	39	191	10	..	..	..	240
April	12	118	6	2	8	12	158
Total	1164	1282	90	2	15	13	2566

Graphic representation of the results of the catch.

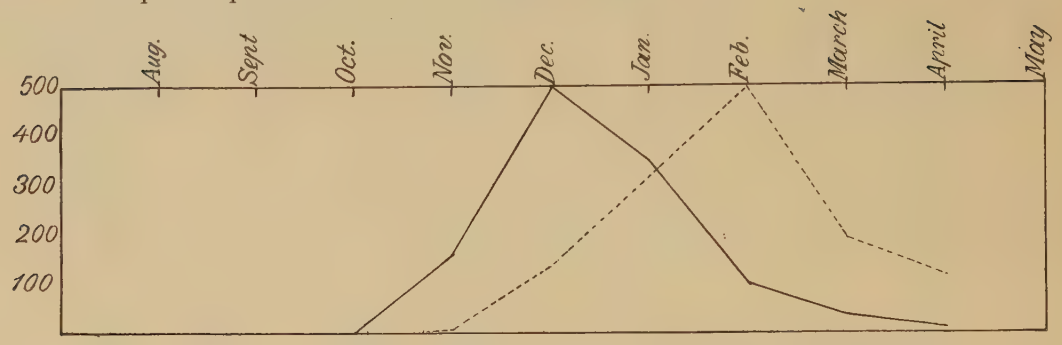

Figure 12. Number of Whales at South Shetlands 1923—1924.
——— Blue whales. - - - - - - - Fin whales.

For the season 1924—1925 figures are available for all the Norwegian companies, representing in all the catch of 26 boats. Operations commenced during the period October 26th—November 7th and concluded during the period April 10th—April 30th. The total catch per month is shewn in the following table:

Table 13. 1924—1925.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
October	17	..	..	..	..	..	17
November	158	26	..	..	18	..	202
December	214	145	5	..	10	..	374
January	340	443	15	..	2	..	800
February	251	191	7	..	..	..	449
March	127	321	23	..	2	..	473
April	157	361	..	..	1	..	519
Total	1264	1487	50	..	33	..	2834

Graphic representation of the results of the catch.

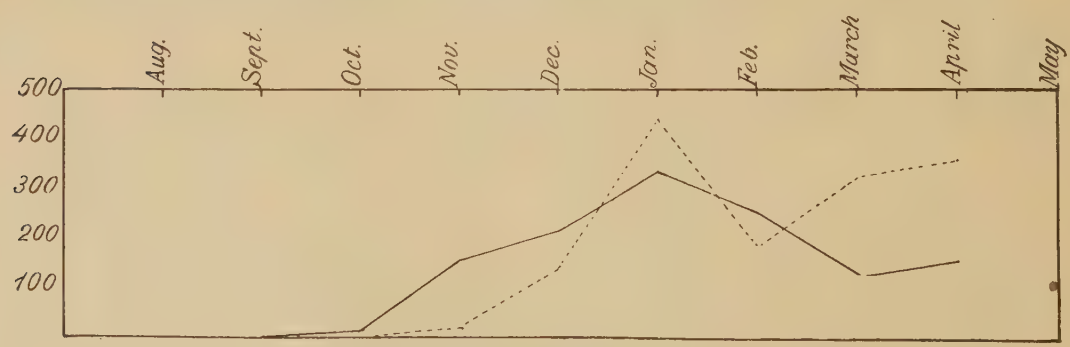

Figure 13. Number of Whales at South Shetlands 1924—1925.
——— Blue whales. - - - - - - - Fin whales.

For the season 1925—1926 figures are available in the case of all the Norwegian companies, representing 26 whaling boats. Operations commenced during the period November 1st—November 13th and concluded during the period April 26th—May 4th. The total catch per month is shewn in the following table:

Table 14. 1925—1926.

Month	Blue whale	Fin whale	Hump-back	Sei whale	Sperm whale	Right whale	Total
November	129	15	..	..	8	..	152
December	515	240	..	..	10	..	765
January	321	581	1	..	2	..	905
February	79	260	67	..	..	..	406
March	84	425	6	3	4	..	522
April	397	158	7	..	..	..	562
May	4	2	..	..	..	..	6
Total...	1529	1681	81	3	24	..	3318

Graphic representation of the results of the catch.

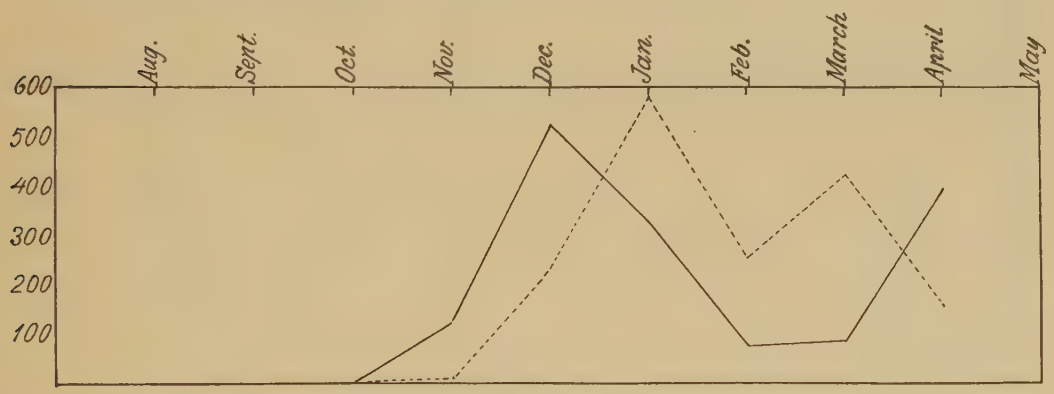

Figure 14. Number of Whales at South Shetlands 1925—1926.
———— Blue whales. - - - - - - - Fin whales.

III.

Occurrence of the Blue Whale and Fin Whale in the Southern Fields.

If on the basis of the present and other existing material we endeavour to form an idea of the occurrence of the blue whale and fin whale in the Southern Fields, South Georgia, South Shetlands and South Orkneys, it is first of all interesting to ascertain whether these whales to any appreciable extent stay in those waters

also outside the actual whaling season. As regards South Shetlands and South Orkneys, it is not possible to answer this question, as no whaling has ever been undertaken outside the real whaling season. The latter, especially in the case of South Orkneys is comparatively short, and we know practically nothing regarding the occurrence of whales there outside the period November—April. Only so much is clear, that when the whaling expeditions arrive there in November there may be a considerable number of whales in the field. They are met along the edge of the ice, and give the impression of making their way southwards towards the banks and slopes where from experience they expect to find their food. At the conclusion of the expedition at the end of March or the beginning of April there is usually a number of whales present even though it may be decreasing.

The same is the case for South Shetlands. As early as in the end of October whalers have in certain years found a quite considerable number of whales, and at the departure of the various expeditions as late as in the beginning of May there has even been a not inconsiderable number in those waters. It is, however, impossible to say how long they remain there. In the case of South Georgia, however, the conditions are different, for there for a number of years "winter whaling" has been carried on after the conclusion of the real season. We therefore possess from those fields a number of valuable observations.

During a number of years the following whales were captured during the months July—September.

Year	Blue whale	Fin whale	Hump-back	Total
1914	146	24	1	171
1915	89	49	..	138
1916	141	121	4	266
1917	155	33	..	188
1918	28	139	..	167

There was also subsequently reported in the case of 2 or 3 seasons that whales were present in those waters throughout the winter. It is thus quite clear as regards this field, that presumably no inconsiderable number of whales remain each year in the neighbourhood of the island the whole winter. In some years the bulk of these are blue whales, but in other years the fin whale is numerously represented. The humpback on the other hand appears as a rule to a far greater extent entirely to leave the field.

In the year 1914—1915 when 823 humpbacks were caught in the real season, there was not shot a single one during the period July—September. In the season 1915—1916 there were shot 1574 humpbacks, but in the following "winter season" only 4. For the year 1916—1917 the corresponding figures are 378 and 0.

Whilst it is thus clear that during the winter in those waters there occur larger or smaller numbers of blue whales and fin whales in the waters off South

Georgia, it is equally certain that these numbers are always far below those which normally occur in the field during the real season.

In other words, it is beyond all doubt that these species of whales undertake migrations which with more or less regular annual intervals take them away and back from the fields in the Southern Seas.

Norwegian whalers have had no opportunities of a very close study of the whales' conditions of food in the Southern Fields. This is partly because they have not the training in this special matter which would enable them to produce results of importance, and also because they entirely lack the apparatus necessary for that kind of investigation, and finally because as a rule their time is entirely occupied with the exercise of their own work.

It must, however, be assumed that these conditions have now been thoroughly investigated by the British "Discovery Expedition" and the results of these investigations will before very long be forthcoming in their final form.

It will then beyond all doubt be shewn that the periodic stay of the whale in Southern waters must be viewed in close connection with the occurrence and extent of the food preferred by and sought after by the various kinds of whales. The migrations of the whales to the Southern Seas must be migrations in search of food.

The figures and curves given in this account shew that already at the end of September the shoals of whales begin to approach the banks off South Georgia, and it is quite evident that they consist of both blue whales and fin whales. A more thorough investigation will further shew that the two species very often occur at definite localities in the waters which form the immediate environs of the Archipelago.

Although it would appear that from the beginning of the whaling season we meet both blue whales and fin whales, yet the rule is that at the beginning of the whaling season the blue whale is present in the greatest quantities, so that its occurrence characterises the stock of whales and thereby also the catch.

In the course of the month of October the number of blue whales increases, and in the majority of whaling years it is the species which is most numerously represented. In certain whaling seasons, e. g. 1919—1920 and 1920—1921, the fin whale is best represented amongst a stock of whales, and the curves of the catch throughout the season shew that when such is the case there are on the whole in such years no very large quantities of blue whales in those waters.

If the quantities of blue whales in the month of November, as is often the case, appear to be greatly on the increase, we shall, as will appear from all the curves of the catch in those waters, have a marked blue whale season in the immediately succeeding months. If not, we have a fin whale season. It is the arrival of whales in the month of November which is here the decisive factor. The arrival of blue whales has thus for a number of seasons, e. g. 1922—1923, 1923—1924 and 1924—1925, culminated in the month of December, whilst the point of culmination

in 1919—1920 did not occur until January and in 1921—1922 as late as in the month of February.

In the typical fin whale seasons, e. g. 1920—1921 and most markedly in the season 1925—1926, there may come a new arrival of blue whales as late as in March. Such an arrival of blue whales may even come at that time of the year in an otherwise abundant blue whale year, e. g. 1922—1923 and 1924—1925. However, it appears to be the rule that the number of blue whales, in any case from the end of the month of January, is markedly on the decrease.

As already mentioned the fin whale arrives somewhat later, and as a rule culminates in the month of January—February. In one year only, 1921—1922, did it culminate as early as in December. As a rule this species of whale forms the majority during the last month of the year.

In the course of the month of May the bulk of both blue whales and fin whales leave those waters, although representatives of both species to a greater or lesser extent, as already mentioned, remain in the field throughout the winter. It is not possible to form any definite opinion as to whether these are the same individuals which have also spent a greater part of the summer there.

The situation is less complicated at South Shetlands. All the curves of catch shew that the blue whale is always earlier than the fin whale. When the whaling fleet goes southwards in the time before the end of October to the end of November, blue whales are always to be found. In years when there is a great deal of ice, and on the early arrival of the fleet, the blue whale is found along the edge of the ice which blocks access from the North and North East, and in years when there is less ice and when arrival in the field is later, the blue whale is found at the entrance of Bransfield Strait and in that Strait. The catch during the whole of the month of November consists almost entirely of blue whales, and in most years these conditions remain until far into the month of December. In certain years there are a number of whaling boats which do not catch a single fin whale before the end of December.

The curves of the catch shew a markedly increasing number of blue whales throughout December, whilst at the same time during the latter half of that month the fin whale begins to appear. The arrival of blue whales culminates in most cases during the period December 20th—January 15th. The whale then proceeds southwards along Graham's Land into the waters with more abundant ice between the Islands in the Southern part of the group.

At the same time the arrival of fin whales increases, and during the period January 15th—February 15th the catch becomes almost constantly a more markedly fin whale catch, so that this species of whale from that time characterises whaling activities.

After the end of the month of February the number of blue whales as a rule greatly decreases, whilst the fin whale for some time after may give very good

results. This has especially been the case in a number of recent years, and to such an extent that it has been possible to reckon with the period March 20th until the end of April as an especially good whaling period.

In one year only, 1925—1926, has this late season been characterised by blue whales, since at the beginning of April there again appeared a considerable number of blue whales in those waters. Curiously enough, the arrival of the blue whale in the late season 1925—1926 coincides with a comparatively large occurrence of blue whales at South Georgia in March—April. The quantities had, however, a different character in the two fields. Since at South Georgia it principally consisted of moderately large and small animals, whilst at South Shetlands it consisted of full grown animals, in some cases the largest which had ever been recorded in our statistics of measurements.

Although the catch in those waters is never carried on until the first days of May, so that we have no observations from the immediately succeeding period, it may be definitely assumed that, with the approach of winter and the rapid formation of ice in Straits and Sounds, the whales retire from the fields and trek northwards towards more temperate waters.

What is mentioned above appears from the study of the catch statistics for the years 1919—1926. As regards the migration of the whales to the fields in the Southern Seas, a number of observations have since been made by whaling expeditions and transport vessels on their way to and from the whaling fields, and which further confirm the main features of the conclusions just reported.

It is, however, of interest to view first of all the occurrence of these species of whales in the fields of the Southern hemisphere which lie outside Antarctic regions. In later years a considerable number of blue whales and fin whales have been caught at various stations on the Coast of Africa. Thus stations at Durban, Saldanha Bay, Walvis Bay and Angola have in recent years made considerable catches of blue whales and fin whales, and the animals also appear there periodically, and at times which lie outside the real whaling season in the Southern Seas. I give a number of catch statistics from Saldanha Bay and in order to give a general survey I have also reproduced these returns in graphic form. In the years 1919—1925 the following catch of blue whales was made:

Table 15.

Year	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1919	..	6	13	15	9	9	5	4	1
1920	..	5	12	31	16	19	33	9	..
1921	No statistics.								
1922	9	..	95	119	103	172	65	36	..
1923	5	67	58	74	85	127	26	1	..
1924	2	15	41	71	81	64	41	2	..
1925	3	30	69	103	82	86	42	15	..
Total...	19	123	288	413	276	477	212	67	1

The following table shews the catch of fin whales during the same period.

Table 16.

Year	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	
1919	1	30	33	33	5	11	7	15	13	Irvin & Johnson
1920	..	13	27	16	4	15	27	32	..	—
1921	No statistics.									
1922	7	..	39	27	15	47	84	69	..	Both companies
1923	1	56	36	43	36	45	98	14	..	Irvin & Johnson
1924	25	49	63	63	38	47	66	27	..	—
1925	3	73	54	86	68	34	45	51	..	
Total...	37	221	252	268	166	199	327	208	13	

The above curves give a representation of these conditions.

Whaling statistics from Walvis Bay, comprising a three years' catch shew the following figures for blue whales.

Table 17.

Year	April	May	June	July	Aug.	Sept.	Oct.
1924	..	..	16	47	66	26	..
1925	1	30	35	57	71	29	..
1926	..	23	37	38	64	50	14
Total...	1	53	88	142	201	105	14

During the same period the following numbers of fin whales were caught.

Table 18.

Year	April	May	June	July	Aug.	Sept.	Oct.
1924	..	..	4	2	1	..	..
1925	..	18	12	5	1	1	..
1926	..	9	11	11	9	3	1
Total...	..	27	27	18	11	4	1

Statistics from the Angola Coast give the following information regarding the occurrence of blue whales there.

Table 19.

Year	April	May	June	July	Aug.	Sept.	Oct.
1924	..	..	..	21	39	14	1
1925	..	..	..	26	67	39	3
1926	..	12	41	65	61	69	55
Total...	..	12	41	112	158	122	59

During the same period the following numbers of fin whales were captured.

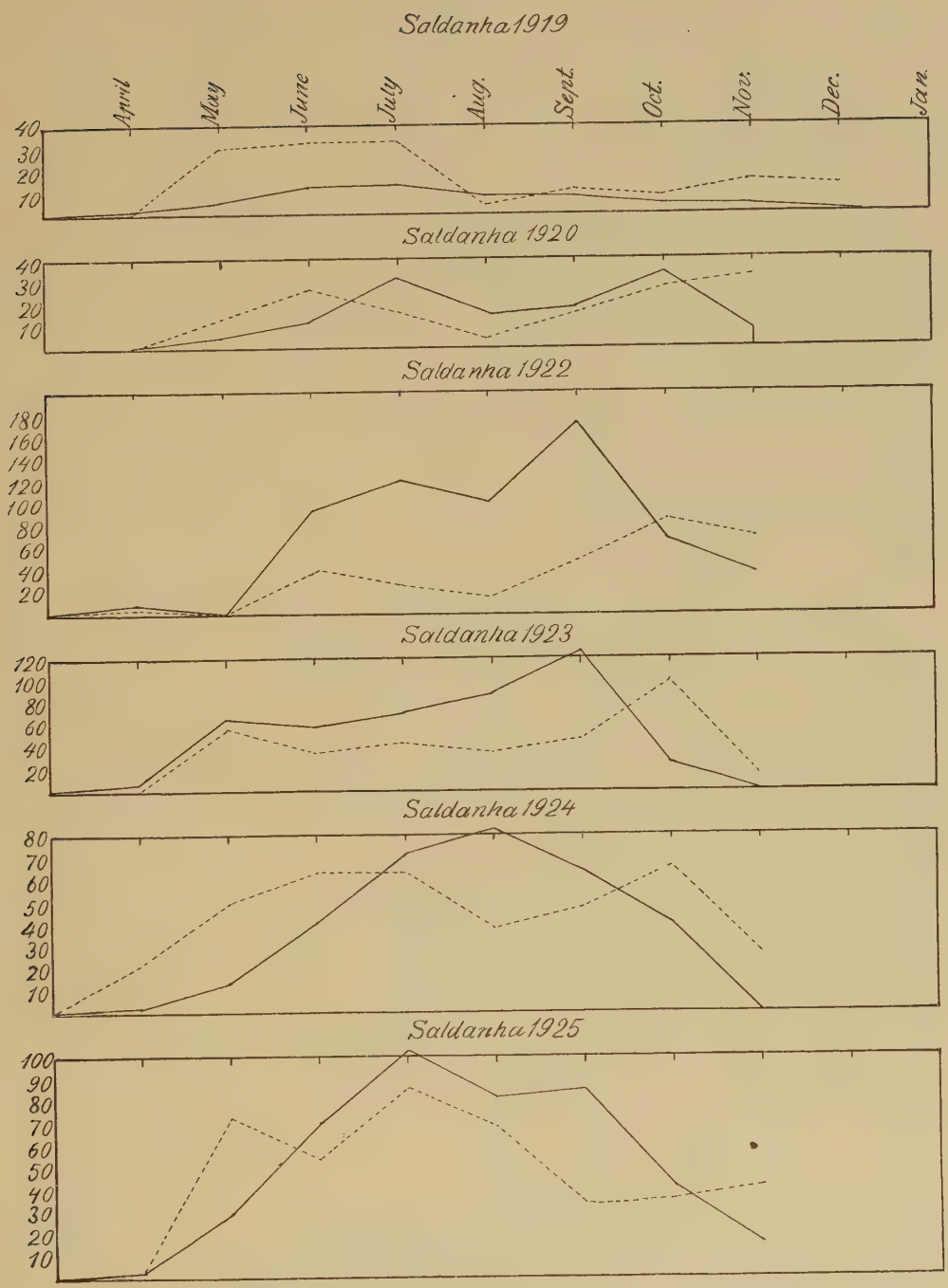

Figure 15. Catch of Whales at Saldanha Bay.
———— Blue whale. - - - - - - - Fin whale.

Table 20.

Year	April	May	June	July	Aug.	Sept.	Oct.
1924	..	..	..	6	7	2	2
1925	..	..	..	11	10	17	4
1926	..	18	10	4	1	4	3
Total	..	18	10	21	18	23	9

These statistics from the West Coast of Africa clearly shew that there still are found considerable numbers of blue whales and fin whales there. These occurrences, however, are periodical, since on the whole the appearance of these species of whales corresponds to that time of the year when the animals are least numerous in the Southern Fields.

As early as in April both the blue whale and the fin whale appear in the field off Saldanha Bay, whilst it is not until May that they appear at Walvis Bay and still later at Angola. It is true that whaling operations at Walvis Bay do not begin until later in the year than those at Saldanha Bay, but the remarkable increase in numbers at the beginning of the whaling season appears to indicate that migration of the animals has just taken place.

The quantities of blue whales and fin whales in these West African waters culminates in July—September, exactly at the time when the numbers are least in the Southern Field, indeed even as concerns the South Orkneys and South Shetlands it must be assumed that they do not occur in those waters at all.

During October the numbers along the coast of Africa rapidly decrease, but in some years there is still a not inconsiderable occurrence at Saldanha Bay, whilst practically speaking the animals appear to have disappeared from the Northern Fields off the Coast of West Africa.

It further appears from the statistics given that the fin whales on the whole do not go so far North as the blue whale. Whilst both species are practically speaking equally numerous at Saldanha Bay, the occurrence of fin whales both at Walvis Bay and Angola is only inconsiderable as compared with the simultaneous occurrence of blue whales.

These conclusions which are taken straight from whaling statistics are also confirmed by whalers, who for a number of years have worked in those waters from day to day.

IV.

The size of the whale in the Southern Whaling Fields.

In various publications which in the course of the past year have appeared regarding the various species of whales, there are found a number of details regarding the size of the blue whale and fin whale. These measurements, however, refer as

a rule to only a few animals and the average measurements of a very large number of whales has thus, as far as I am aware, not been published hitherto.

On the basis of the previously mentioned statistics of measurement there have now been undertaken average calculations of the size of many thousands of blue whales and fin whales. The size has thus been exactly ascertained.

These calculations have been made specially for each year for a number of years and we have, therefore, an opportunity of observing the average size of the stock from year to year. Finally, special measurements have been made for the two sexes, so that it is possible to determine the difference in size between them.

The measurements were made by all the Norwegian whaling expeditions in the Southern Seas, both at the fixed stations and on the floating factories. The whale was measured in a straight line from the point of the snout to the end of the tail between the cleft in the cadual fin. It should be observed that on account of the frequently difficult conditions under which measurements were taken, the latter are not quite exact. They are most accurate when taken at fixed stations because it is easier to carry them out there than on the floating factories. In spite of this, when seen as a whole, the measurements must be considered sufficiently accurate to give a complete view of the conditions of size of the whales in any definite field during the year in which such measurements were undertaken.

I give below in table form the result of measurements made in Southern Seas for the seasons 1922—1923, 1923—1924 and 1924—1925. There exist, however, similar figures for a further three years, but they differ so little from those given that I have found no reason to include them. It should be observed that these figures have in part been previously published in the organ of the Norwegian Whalers' Association, viz. "Norsk Hvalfangsttidende".

The calculations have been made specially for each whaling company. I have, however, desired not to mention the name of the company in this connection, but I have chosen to designate it by a number.

The measurements thus presented here shew that the average size of the blue whales caught in the Southern Seas vary somewhat, even though they do not do so in the various years, e. g. from 23.96 metres in the season 1924—1925 to 24.51 metres in the season 1923—1924.

It further appears that the average size of the 6925 animals here measured amounts to 24.16 metres, so that the 3712 males have an average size of 23.68 metres and the 3213 females an average size of 24.72 metres.

It further appears that on an average considerably more males are caught than females. For every 100 females there are caught 115 males. The males constitute 53.6 % of the total catch and the females 46.4 %. The number of blue whales in the Southern Fields consists of animals of various sizes, but the statistics of measurement very rarely include animals under 40 feet (12.55 metres) in length. The largest blue whales caught rarely exceed a length of 100 feet (31.38 metres).

Table 21.

The average size of the blue whale in the Southern Seas 1922—23.

Whaling Ground	Company	Average size of males	Average size of females	Average size of all animals
South Georgia	Company I	22.71 m.	23.88 m.	23.24 m.
— —	— II	23.05 -	24.78 -	23.93 -
	Average size for S. Georgia	22.92 m.	24.46 m.	23.68 m.
South Shetlands	Company I	22.85 m.	24.76 m.	23.74 m.
— —	— II	24.28 -	24.06 -	24.16 -
— —	— III	25.20 -	25.62 -	25.44 -
— —	— IV	24.40 -	24.70 -	24.53 -
— —	— V	23.92 -	25.74 -	24.63 -
— —	— VI	24.07 -	25.53 -	24.65 -
— —	— VII	23.96 -	24.45 -	24.22 -
	Average size for S. Shetlands	23.96 m.	24.93 m.	24.42 m.
Average size for the whole of the Southern Seas		23.55 m.	24.73 m.	24.12 m.

This statement comprises 1106 males and 1024 females = 2130 animals.

Table 22.

The average size of the blue whale in the Southern Seas 1923—24.

Whaling Ground	Company	Average size of males	Average size of females	Average size of all animals
South Georgia	Company I	22.78 m.	24.09 m.	23.38 m.
— —	— II	23.84 -	25.00 -	24.46 -
— —	— III	24.64 -	24.96 -	24.77 -
	Average size for S. Georgia	23.70 m.	24.64 m.	24.13 m.
South Shetlands	Company I	24.85 m.	24.98 m.	24.90 m.
— —	— II	23.63 -	25.28 -	24.25 -
— —	— III	24.00 -	25.00 -	24.40 -
— —	— IV	23.62 -	24.53 -	24.13 -
— —	— V	25.27 -	25.68 -	25.45 -
— —	— VI	24.04 -	24.63 -	24.37 -
— —	— VII	25.87 -	25.79 -	25.84 -
	Average size for S. Shetlands	24.51 m.	25.12 m.	24.78 m.
South Orkneys	Company I	24.91 m.	25.35 m.	25.12 m.
Average size for the whole of the Southern Seas		24.17 m.	24.91 m.	24.51 m.

This statement comprises 1047 males and 888 females = 1935 animals.

Table 23.

The average size of the blue whale in the Southern Seas 1924—25.

Whaling Ground	Company	Average size of males	Average size of females	Average size of all animals
South Georgia	Company I	22.68 m.	23.91 m.	23.14 m.
— —	— II	23.75 -	24.86 -	24.26 -
— —	— III	24.43 -	25.00 -	24.70 -
	Average size for S. Georgia	23.51 m.	24.57 m.	23.98 m.
South Shetlands	Company I	24.70 m.	25.16 m.	24.88 m.
— —	— II	23.46 -	24.29 -	23.76 -
— —	— III	23.09 -	23.39 -	23.26 -
— —	— IV	23.55 -	24.05 -	23.86 -
— —	— V	23.31 -	24.57 -	23.94 -
— —	— VI	23.93 -	25.24 -	24.59 -
— —	— VII	23.42 -	25.01 -	23.86 -
	Average size for S. Shetlands	23.59 m.	24.43 m.	24.00 m.
South Orkneys	Company I	22.34 m.	25.03 m.	23.39 m.
Average size for the whole of the Southern Seas		23.45 m.	24.59 m.	23.96 m.

This statement comprises 1559 males and 1301 females = 2860 animals.

The largest blue whale recorded in our statistics was a specimen 106 feet (33.27 metres) in length. It was a female caught at the South Shetlands in March 1926. About the same time there was caught at the same place a male 104 feet in length (32.64 metres). Only five specimens of 100 feet and upwards are recorded in our measurement statistics, and these were all females, 3 of whom were caught at South Georgia and 2 at South Shetlands.

In order to give a clearer picture of the stock of whales in any particular year I have divided the stock into three groups, we have

Group 1 blue whales 70 feet and less,
Group 2 blue whales, between 71 and 85 feet,
Group 3 blue whales, over 85 feet.

If this division is applied to the whole catch of blue whales in the season 1924—1925, we find the following percentage of animals in the three groups of size.

Group 1 (up to 70 feet)	27.9 %
Group 2 (71—85 feet)	59.2 -
Group 3 (over 85 feet)	12.9 -
	100.0 %

I have previously in the "Norsk Hvalfangsttidende" published similar calculations also for earlier years, and it appears on comparison of these calculations that the size of the different groups may vary somewhat from one year to another.

These variations, however, are never great, and as a rule depend upon the greater or lesser migration to a field of the young whales.

As regards the number of fin whales the size during the same year was as follows:

Table 24.

The average size of the fin whale in the Southern Seas 1922—23.

Whaling Ground	Company	Average size of males	Average size of females	Average size of all animals
South Georgia	Company I	21.12 m.	21.70 m.	21.39 m.
— —	— II	20.78 -	22.34 -	21.52 -
	Average for South Georgia	20.97 m.	22.00 m.	21.45 m.
South Shetlands	Company I	19.45 m.	20.28 m.	19.84 m.
— —	— II	19.81 -	19.54 -	19.68 -
— —	— III	19.98 -	20.05 -	20.01 -
— —	— IV	20.99 -	20.50 -	20.76 -
— —	— V	20.98 -	22.13 -	21.39 -
— —	— VI	20.80 -	21.45 -	21.01 -
— —	— VII	17.71 -	17.62 -	17.66 -
	Average for South Shetlands	19.89 m.	19.99 m.	19.94 m.
	Average for the whole of the Southern Seas	20.10 m.	20.40 m.	20.23 m.

This statement comprises 889 males and 768 females = 1657 animals.

Table 25.

The average size of the fin whale in the Southern Seas 1923—24.

Whaling Ground	Company	Average size of males	Average size of females	Average size of all animals
South Georgia	Company I	19.13 m.	20.56 m.	19.87 m.
— —	— II	21.14 -	22.32 -	21.88 -
— —	— III	21.90 -	22.12 -	22.00 -
	Average for South Georgia	20.62 m.	21.57 m.	21.13 m.
South Shetlands	Company I	19.46 m.	19.64 m.	19.54 m.
— —	— II	21.41 -	22.22 -	21.63 -
— —	— III	20.15 -	20.97 -	20.48 -
— —	— IV	19.55 -	20.06 -	19.78 -
— —	— V	19.36 -	19.20 -	19.29 -
— —	— VI	20.43 -	21.10 -	20.75 -
— —	— VII	20.83 -	21.32 -	21.04 -
	Average for South Shetlands	20.26 m.	20.63 m.	20.42 m.
South Orkneys	Company I	22.01 m.	22.91 m.	22.33 m.
	Average for the whole of the Southern Seas	20.48 m.	21.13 m.	20.78 m.

This statement comprises 890 males and 753 females = 1643 animals.

Table 26.

The average size of the fin whale in the Southern Seas 1924—25.

Whaling Ground	Company	Average size of males	Average size of females	Average size of all animals
South Georgia	Company I	19.91 m.	21.49 m.	20.65 m.
— —	— II	21.43 -	22.39 -	21.90 -
— —	— III	20.34 -	20.90 -	20.57 -
	Average for South Georgia	20.41 m.	21.50 m.	20.92 m.
South Shetlands	Company I	20.25 m.	20.53 m.	20.37 m.
— —	— II	20.87 -	21.56 -	21.13 -
— —	— III	22.13 -	22.15 -	22.14 -
— —	— IV	20.19 -	19.87 -	20.01 -
— —	— V	20.35 -	20.94 -	20.60 -
— —	— VI	21.55 -	21.64 -	21.60 -
— —	— VII	19.32 -	19.69 -	19.44 -
	Average for South Shetlands	20.63 m.	21.03 m.	20.81 m.
South Orkneys	Company I	20.56 m.	22.21 m.	20.89 m.
Average for the whole of the Southern Seas		20.54 m.	21.28 m.	20.86 m.

This statement comprises 1511 males and 1131 females = 2642 animals.

The variations in the average size from one year to another are thus not great also in this case, from 20.23 metres in 1922—1923 to 20.86 metres in 1924—1925.

It further appears that the average size of the 5942 animals measured here amounts to 20.66 metres, in that the 3290 males have an average size of 20.40 metres and the 2652 females have an average size of 20.98 metres.

The catch of fin whales also shews that there are always caught more males than females. This condition is even more strongly marked in the fin whale catch than in the blue whale catch. For every 100 females there are caught 124 males, so that the latter constitute 55.4 % of the total catch, whilst the females only constitute 44.6 %.

The number of fin whales in the Southern Seas also consists of animals which vary greatly in size. According to the figures animals are rarely caught under 40 feet in length (12.55 metres) and the largest fin whale caught very rarely exceeds a length of 85 feet (26.67 ms.).

The largest fin whale included in our statistics was a specimen 87 feet in length (27.3 ms.). It was a female caught at the South Shetlands in January 1925.

In order to give a clearer picture of the number of fin whales in any particular year I have also made a classification of the stock in three groups.

Group I fin whales 55 feet and less in length (small animals).
Group II fin whales between 56 and 65 feet in length (middle sized animals).
Group III fin whales over 65 feet in length (large animals).

If this classification is applied to the total catch of fin whales in the season 1924—1925, we find the following percentage of animals in the three groups of size:

Group I (up to 55 feet)	4.24 %
Group II (56—65 feet)	37.36 -
Group III (over 65 feet)	58.40 -
	100.00 %

Comparative calculations for several years shew that the mutual conditions of size for this species of whale may also vary somewhat in various years. These variations, however, are not great in this case and the percentage distribution of the animals within the various groups of size is on the whole surprisingly even. But a larger or smaller immigration of young ones to the whaling field can of course disturb the conditions to some extent, and mostly between the two first groups.

For the purposes of comparison it is of interest to consider the size of the blue whales and fin whales caught outside the Southern Seas. We have here a number of measurement statistics, although the number of animals measured is far smaller than that from the actual Southern Whaling Fields. There are forthcoming, however, from the various whaling fields in the Northern Seas a considerable number of measurements, especially of fin whales, which in those waters are everywhere the predominating factor in present day whaling. There are thus forthcoming in the material of measurements published by the Norwegian Whalers' Association for the years 1922—1925 from the following fields:

West Coast of Greenland	35	males,	31	females	i. e.	66	animals
Færoes	173	—	173	—	—	346	—
West Coast of Norway	197	—	196	—	—	393	—
West Coast of Iceland	22	—	21	—	—	43	—
Shetlands	42	—	67	—	—	109	—
Newfoundland	87	—	62	—	—	149	—
Kamtchatka	101	—	52	—	—	153	—
Total...	657	males,	602	females	i. e.	1259	animals

As will be seen the majority of these measurements come from the whaling fields which are in connection with the Atlantic. The stock of fin whales of the Northern Pacific is only represented by the few measurements from the coast of Kamtchatka.

The material collected gives the following dimensions:

Whaling Field	Average size of males	Average size of females	Average size of all animals
West coast of Greenland	18.86 m.	19.99 m.	19.40 m.
Færoes	18.60 -	19.40 -	19.00 -
West coast of Norway	18.72 -	19.71 -	19.21 -
Shetlands	20.16 -	20.35 -	20.28 -
Newfoundland	16.56 -	17.64 -	17.01 -
Kamtchatka	17.78 -	17.94 -	17.83 -

The material collected gives the following statistics regarding size.

Males 18.38 m., females 19.31 m., all animals 18.83 m. We thus arrive at the result that the fin whale in the Southern Fields are considerably larger than those in the Northern Fields. Whilst the animals in the Southern Seas had an average size of 20.66 m., the Northern stocks had only an average size of 18.83 m., a difference of 1.83 m. These conditions, however, are well known amongst active whalers who have carried on activities in both regions.

In order to obtain a general view of the size of the Southern fin whales, I have divided them into three groups. If we employ the same classifications in the case of the fin whales of the Northern Seas, we arrive at the following results (the corresponding percentage figures for the Southern Seas are placed in brackets for the purposes of comparison).

Group I (up to 55 feet)	24.86 %	(4.24 %)
Group II (56—65 feet)	53.62 -	(37.36 -)
Group III (over 65 feet)	21.52 -	(58.40 -)
	100.00 %	(100.00 %)

The difference is thus very striking and it will be a task for the future to elucidate these conditions.

With regard to the blue whale only a few measurements are available from the Northern Whaling Fields. The fact is that this species of whale is comparatively rare in the waters where the Atlantic passes over to the Arctic Seas. But in spite of the fact that the number of measurements is so small that I dare not draw any conclusions from them, I should like to include those which are forthcoming. The following statistics have been sent in:

Greenland 1924	23	males,	18	females	i. e.	41	animals	
West Coast of Ireland 1922	5	—	5	—	—	10	—	
Shetland 1920	9	—	5	—	—	14	—	
Newfoundland 1925	8	—	4	—	—	12	—	
Total...	45	males,	32	females	i. e.	77	animals	

All the measurements thus come from animals belonging to the North Atlantic blue whales. On the coast of Kamtchatka the Norwegian whaling ex-

peditions have scarcely ever met blue whales, and I have not succeeded in obtaining measurements from Japan. The existing material gives the following figures regarding size:

Whaling Field	Average size of males	Average size of females	Average size of all animals
Greenland	23.22 m.	25.73 m.	24.32 m.
West coast of Ireland	22.53 -	22.66 -	22.59 -
Shetland	21.94 -	23.41 -	22.46 -
Newfoundland	21.34 -	23.69 -	22.12 -

The average size for all fields is thus: males 22.56 m., females 24.64 m., all animals 23.42 m. It would appear from these measurements that the blue whale in the Southern Seas is also larger than the blue whale in the Northern Seas. Whilst the southern whales had an average size of 24.16 m., the average size of the northern whales is only 23.42 m.

The fact that the difference is not greater is due to the circumstance that no measurements of blue whales under 17.5 m. have been recorded, whilst from the Southern Seas not a few animals below this size have been registered. The largest animal which was measured in the Northern Seas had a lengh of 27.5 m., whilst in the Southern Seas there are constantly caught animals which far exceed those dimensions.

In the Northern Seas the blue whale never reaches the huge size which may be the case in the Southern Seas.

There are also available from the more tropical and temperate fields a number of measurement statistics which are of great interest. These statistics first and foremost comprise blue whales but also include a number of fin whales.

As regards the blue whale the measurements come from the following fields:

Hangklip, South Africa	21	males,	35	females	i. e.	56	animals
Walvis Bay, West Africa	177	—	196	—	—	373	—
Elephant Bay, West Africa	110	—	98	—	—	208	—
Coast of Natal, East Africa	103	—	111	—	—	214	—
Total...	411	males,	440	females	i. e.	851	animals

The existing material gives the following figures as regards size:

Whaling Field	Average size of males	Average size of females	Average size of all animals
Hangklip	22.56 m.	23.32 m.	23.03 m.
Walvis Bay	20.10 -	21.02 -	20.60 -
Elephant Bay	18.20 -	18.76 -	18.50 -
Coast of Natal	20.50 -	22.03 -	21.24 -

I also include measurements of fin whales from the same waters, the following figures being available:

Hangklip	36	males,	45	females	i. e.	81	animals
Walvis Bay	22	—	15	—	—	37	—
Elephant Bay	21	—	17	—	—	38	—
Coast of Natal	174	—	162	—	—	336	—
Total...	253	males,	239	females	i. e.	492	animals

The material gives the following conditions as regards size:

Whaling Field	Average size of males	Average size of females	Average size of all animals
Hangklip	20.74 m.	21.12 m.	20.96 m.
Walvis Bay	16.20 -	17.10 -	16.54 -
Elephant Bay	14.84 -	14.05 -	14.60 -
Coast of Natal	19.60 -	19.90 -	19.74 -

It appears from these measurements that the size of both the blue whale and the fin whale varies very greatly at different parts of the coast of Africa. It further appears that the average size of the animals is larger on the South and East Coast than on the West Coast. Thus the coast of Hangklip and Natal shew in the case of the blue whale 23.03 metres and 21.24 metres respectively, as opposed to Walvis Bay and Elephant Bay on the West Coast with 20.6 m. and 18.50 m. respectively.

As regards fin whales the conditions are even more striking. We find on the South and East Coast at Hangklip and in Natal, an average length of 20.96 m. and 19.74 m., as opposed to Walvis Bay and Elephant Bay on the West Coast with respectively 16.54 m. and 14.6 m.

It further appears from the measurements that the average size of the animals decreases the farther we come North along the coast. As will be seen this applies both to the South and East Coast and also to the West Coast. Thus as regards the blue whale we find on the South Coast at Hangklip an average of 23.03 m. and on the Coast of Natal 21.24 m. As regards the fin whale the average size is 20.96 m. at Hangklip and 19.74 m. off the coast of Natal.

On the West Coast we again find the same conditions. As regards the blue whale we have averages of 20.6 m. in Walvis Bay and 18.5 m. in Elephant Bay, and as regards the fin whale 16.54 m. in Walvis Bay and 14.6 m. in Elephant Bay.

These conditions are so striking that it is of interest to give them further investigation. The question is then to find what kind of animal the stock consists of, and I must again make use of classification in groups: small animals 70 feet and less, medium sized animals from 71—85 feet and larger animals, the size of which exceeds 85 feet.

This selection of limits between the groups is not arbitrary, but has been made because it indicates certain stages of development in the growth of the blue whale. For the fact is that in general animals under the length of 70 feet are seldom found fecundated. On the other hand it is a fact that when the blue whale has attained a size of about 85 feet it has finished its rapid period of growth. It is in a way fully grown, and further growth takes place at a much slower rate than before. This boundary only applies to the southern whale. As I have already shewn it is considerably larger than the blue whale in the Northern Seas. The growth of the whale, however, will be made the subject of a more detailed treatment in a later chapter.

I will now employ the group division upon the blue whales measured off the Coast of Africa, and for the purposes of a general survey compare them with the stock in the Southern Seas.

Table 27.

Group	Hangklip		The Coast of Natal		Walvis Bay		Angola		Southern Fields	
	Number of animals	%	Number of animals	%	Number of animals	%	Number of animals	%	Number of animals	%
I	18	32.1	129	60.3	286	76.7	188	90.4	797	27.9
II	35	62.5	71	33.2	74	19.8	19	9.1	1693	59.2
III	3	5.4	14	6.5	13	3.5	1	0.5	370	12.9
Total	56	100.0	214	100.0	373	100.0	208	100.0	2860	100.0

If one employs the group division (Group I, fin whales up to 55 feet, Group II, fin whales between 56 and 65 feet and Group III, fin whales over 65 feet) upon the fin whales measured off the Coast of Africa, the following result is obtained:

Table 28.

Group	Hangklip		The Coast of Natal		Walvis Bay		Angola		Southern Fields	
	Number of animals	%	Number of animals	%	Number of animals	%	Number of animals	%	Number of animals	%
I	4	4.9	34	10.1	25	67.6	37	97.4	112	4.24
II	25	30.9	117	34.8	10	27.0	1	2.6	987	37.36
III	52	64.2	185	55.1	2	5.4	0	0.0	1543	58.40
Total	81	100.0	336	100.0	37	100.0	38	100.0	2642	100.00

(It should be noted that the group division for fin whales has been calculated according to their growth proportion in the North Sea. The division for the Southern Seas would be: Group I up to 60 feet, Group II 61 to 75 feet and Group III over 75 feet, which corresponds better with the fin whales' proportion of development).

It thus appears that when the shoals of whales in their annual migrations from the Southern Fields reach the South Coast of Africa, they have as regards size about the same character as in the Southern Fields. The bulk consists of medium sized and large animals. Mother animals are very numerously represented, and as regards fin whales even in equally large numbers as in the Southern Seas.

As soon as we travel some distance northwards along the coast the conditions change. It is, therefore, improbable that the whole migration of blue whales and fin whales first travel towards the South Coast of Africa, so much the more so because even in the months of June and July the animals frequently appear to come from the North.

A number of these animals are also so lean that it is inconceivable that they could have come from the fields of the Southern Seas where there is such an abundance of food. Now and then we come across large and extremely fat animals, especially pregnant females, whilst at the same time and at various periods we see very lean animals. It seems to be difficult to explain the conditions there in any other way than by stating that the stock of whales there partly consists of animals from the Southern Seas who have resorted northwards and partly of a majority of young animals who have stayed off the coast in the open sea and then for a shorter or longer time have gone in nearer to the coast.

I do not believe that it will ever be possible to understand with certainty the migrations of whales in those waters on the basis of statistics from the fields and local investigations at the whaling stations. On the other hand I hope that by means of the whale markings which the Discovery Expedition started it will be possible by degrees to elucidate these questions, provided that the markings can be made effectively and to some considerable extent.

One thing, however, is quite clear from the measurement statistics forthcoming, and that is that the farther we proceed northwards, especially on the West Coast, the more young whales predominate, in some cases quite young animals. It is rarely that we find fully grown, fat valuable animals.

Even at Saldanha Bay the stock is greatly characterised by young animals and at Walvis Bay this condition is even more striking. The animals there, however, are on the average somewhat more valuable as a number of large, and in some cases huge animals resort towards the banks off the coast, whilst at Angola the stock is practically void of large valuable animals, as will appear with unpleasant clearness from the calculations of the products of oil of the animals caught given by me in the next section. The stock consists there of young ones and quite young animals, lean and strongly attacked by all kinds of parasites, so that the stock conveys an entirely sickly impression.

My statistics shew that at no other place where whaling operations have been conducted have 70 % of the blue whales been under 60 ft. in length and 92 % of the fin whales under 50 ft. in length. As I shall attempt to shew

in a subsequent section animals under these lengths are not more than twelve months old.

On the East Coast, however, the stock is of another character. It is true that there, too, there is a marked mixture of quite young animals, but on an average the animals are far more valuable, as will appear very clearly from the statistics of production given in the next section. Yet in the fields off Durban there are no occurrences of Copepods worth mentioning. Both at the "Union Whaling Company's" Station, and at the "Premier Whaling Company's" Station there have been undertaken systematic investigations of the contents of the stomach of the animals caught, and from both Stations it has been reported to me that, as a rule, the animals had quite empty stomachs. They must, therefore, not long before have come from waters containing an abundance of food. It is reasonable to conclude that the bulk of these animals are migratory whales from the Southern Seas which proceed northwards in some cases at a great distance from the shore through the warm Mozambique current on the Coast of Africa.

It is of interest to be able to shew that on the West Coast of South America similar conditions prevail to those which we have just described in the case of the coast of West Africa.

For a large number of years whaling has been carried on along the coast of Chile on the West Coast of South America and whaling activities have been specially concentrated around the Town of Corral in Valdivia and the coast between 37° South Latitude and 44° South Latitude which has been the most popular whaling field.

Further in 1926 whaling was also carried on from the coast of Equador.

Unfortunately we have only scattered measurements from Chile and Peru, but my material from Equador gives the measurements of all the animals shot in those waters.

From a number of statements made by harpoon men and whalers, who for several years have worked off the coast of Chile and whose reports have been placed in conjunction with the scattered measurements of whales which I possess from that coast, it appears, however, that the stock of blue whales mainly consists of medium sized and, to some extent, large whales, whilst young ones and younger animals only appear in small numbers.

As will be seen from the following section of the present work the average products of oil from the whale off the coast of Chile are comparatively high.

Off the coast of Peru the stocks consist more of young whales and medium sized animals, but now and then there are also caught large valuable animals so that the average produce of oil per whale there is about the same as on the coast of Chile.

On the Coast of Equador the conditions are quite different. We have from that district measurements of in all 272 fin whales, 164 males and 108 females.

The average size of the males was 16.24 m., of the females 17.2 m., whilst the average size of all animals was 16.62 m.

Of the animals there belonged to Group I	127	=	46.7 %
- - — — — - — II	119	=	43.7 -
- - — — — - — III	26	=	9.6 -
Total...	272	=	100.0 %

The conditions thus remind us of Walvis Bay, also in that the produce of oil per whale is about the same, and considerably lower than that off the more Southern parts of the coast of South America.

As regards the blue whale there exist measurements of 65 animals, 22 males and 43 females. The males had an average size of 19.90 m., and the females 20.21 m. The average size of all the animals was thus 20.12 m.

Of the animals there belonged to Group I	56	=	86.2 %
- - — — — - — II	9	=	13.8 -
- - — — — - — III	0	=	0.0 -
Total...	65	=	100.0 %

The composition of this stock of blue whales thus resembles that off the coast of Angola. At both places young and quite young animals of extremely little value are shot.

The whales off the coast of Equador are also to a large extent pestered by all kinds of parasites, so that the surface of the blubber is often more or less covered with deep holes filled with matter.

V.

How large produce of oil is obtained on an average from the various species of Whale.

The object of whaling is to produce whale oil and guano from the animal's capture. At certain times the price of whale bone is such that it pays to clean it and preserve it for subsequent sale. This has, however, not been the case in recent years and the sale of whale bone is, therefore, quite at the minimum at the present time.

Whale guano and bone meal on the other hand have a comparatively large sale and, therefore, all whaling companies working from a permanent station in the various fields have taken up that production. There is also occasionally produced guano on some of the floating factories. This, however, has hitherto only occurred

quite exceptionally, and is connected with certain difficulties, first and foremost as regards the limited room on board ship.

The chief product is whale oil, and in the course of years considerable developments have taken place in the direction of utilising the entire animal, so that it is possible to obtain the largest possible quantity of oil per animal. By following this development and its statistics we see how the produce of oil per animal has been increased since Southern whaling commenced, but this, however, is outside the scope of the present work.

My object here is to shew what quantities of oil have been obtained on an average in recent years per animal from the various species of whale. This, however, is not easy. The fact is, it is extremely seldom that the various animals are boiled and kept separately. Several animals often belonging to different species of whale are, as a rule, prepared at the same time, and it is, therefore, only in very rare cases that it is possible to say definitely how many barrels of oil were given by any definite animal. The quantity of oil produced from a whale depends upon a number of different factors, especially the size of the animal, the thickness of the layer of blubber, the content of fat of the blubber and carcase, etc. In the next place it also depends upon the technical and mechanical equipment of the whaling station concerned, and in general upon its capacity to utilise all raw material in an entirely rational and satisfactory manner. The latter factor, however, formerly played a far larger part than it does at the present time, since practically speaking all stations and floating factories have an equipment which in normal circumstances can utilise the raw materials entirely.

Several times average calculations of the products of a whale at the various fields have been made. In the "Report of the Inter-Departmental Committee on Research and Development in the Dependencies of the Falkland Islands" 1920 there thus occur the following figures for South Georgia:

Species of Whale	Average yield of oil in barrels (6 barrels = 1 ton)
Right	60—70
Blue	70—80
Fin	35—50
Sei	10—15
Humpback	25—30
Sperm	60

Figures supplied by Chr. Salvesen & Company, Leith, give the following averages:

Blue	75	barrels
Fin	43	—
Humpback	30	—

The yield of oil of a whale varies extremely. As an example I will give the figures as regards the blue whale:

Largest Yield: Blue Whale caught July 13th, 1924, at Walvis Bay, West Africa, gave a yield of 305 barrels of oil.

Smallest Yield: Blue Whale caught in 1926 off the French Congo gave a yield of 75 kilos (less than half a barrel).

As already shewn in former sections of the present work the average size of the whale varies not a little in the various fields. It also varies somewhat at the same places from one year to another. There is also from one year to another a difference in the degree of fat of the whales even in the same fields. It is thus difficult to draw up an average account of what the various animals can give of oil.

As, however, it is of very great interest to be able to shew, at any rate approximately, the yield of the various species of whale at the various fields, I have for many years endeavoured to draw up an average calculation on a common basis applying to all whaling fields.

The fact is that, in reply to my question as to how much oil the various species of whale gave, I have received in the course of years from a number of whalers the statement that a blue whale on an average gives double as much as a fin whale in the same field. Further, on the basis of many years experience, these men have stated that a blue whale is two and a half times as good as a humpback in the same field, and finally that a fin whale produces as much oil as three seis.

If we collect this into a short formula we have: 1 blue whale = 2 fin whales = $2^1/_2$ humbacks = 6 seis, and on the basis of this we can recalculate the entire catch in terms of blue whales and state the yield in what I will call a blue whale unit. I would, however, observe that this applies to the conditions in the more Arctic and Antarctic Fields.

In the more tropical fields it will be found that, whilst, for instance, the humback may also be fat and valuable, the fin whale and especially the blue whale appear to have a far smaller value than animals of a corresponding size in the more Arctic and Antarctic fields. This will appear with all desirable clearness from the tables which I will now proceed to give.

Calculation of the yield of oil per whale.

1 blue whale = 2 fin whales = $2^1/_2$ humpbacks = 6 seis.

Southern Seas Season 1925—26 and Summer Season 1926.

Southern Seas.

A. South Georgia.

Company I: 425 blue whales, 1183 fin whales, 46 humpbacks = 1035 estimated blue whales

Catch 86,000 barrels = 83 barrels per blue whale unit.

Company II: 268 blue whales, 803 fin whales, 35 humpbacks = 683 estimated blue whales.
Catch 58,200 barrels = 85.2 barrels per blue whale unit.
— III: 222 blue whales, 640 fin whales, 33 humpbacks = 555 estimated blue whales.
Catch 43,850 barrels = 79 barrels per blue whale unit.
Average for South Georgia = 82.7 barrels per blue whale unit.

It is observed that the stock of blue whales at South Georgia in that season was especially small, the average length only amounting to 70.89 feet. The size of the fin whales was normal.

B. South Shetlands.
Company I: 171 blue whales, 173 fin whales, 5 humpbacks = 259 estimated blue whales.
Catch 24,331 barrels = 93.9 barrels per blue whale unit.
— II: 180 blue whales, 119 fin whales, 9 humpbacks = 243 estimated blue whales.
Catch 20,700 barrels = 85.2 — — —
— III: 163 blue whales, 227 fin whales, 3 humpbacks = 278 estimated blue whales.
Catch 24,500 barrels = 88.1 — — —
— IV: 194 blue whales, 255 fin whales, 1 humpback = 322 estimated blue whales.
Catch 25,760 barrels = 80 — — —
— V: 179 blue whales, 184 fin whales, 21 humpbacks = 279 estimated blue whales.
Catch 23,550 barrels = 84.4 — — —
— VI: 181 blue whales, 174 fin whales, 6 humpbacks = 270 estimated blue whales.
Catch 23,160 barrels = 85.7 — — —
— VII: 275 blue whales, 349 fin whales, 7 humpbacks = 452 estimated blue whales.
Catch 41,400 barrels = 91.6 — — —
— VIII: 186 blue whales, 200 fin whales, 29 humpbacks = 298 estimated blue whales.
Catch 24,500 barrels = 82.2 — — —
The average for South Shetlands was 86.6 barrels per blue whale unit.

It is observed that both the blue whale and the fin whale in this field were of normal size.

In these, as in the following statistics, there has been deducted from the catch of the various companies a small quantity of sperm whale oil which was produced from a few specimens of sperm whale caught by each company.

C. South Orkneys:
44 blue whales, 573 fin whales, 4 humpbacks = 332 estimated blue whales.
Catch 27,000 barrels = 81.3 barrels per blue whale unit.

Figure 16. Yield of oil per blue whale unit.

Figure 17. Yield of oil per blue whale unit.

The blue whale in this whaling field was especially small. Its average length was 69.20 feet.

The average for the whole of the Southern Seas was 84.5 barrels per blue whale unit.

Tropical and temperate Fields:

A. Walvis Bay:
226 blue whales, 44 fin whales, 96 humpbacks = 286 estimated blue whales.
Catch 12,860 barrels = 45 barrels per blue whale unit

B. Angola:
303 blue whales, 40 fin whales, 6 humpbacks = 325 estimated blue whales.
Catch 5,400 barrels = 16.6 — — —

C. Saldanha Bay:
356 blue whales, 303 fin whales, 9 humpbacks, 135 seis = 534 estimated blue whales.
Catch 19,300 barrels = 36.2 — — —

D. The Coast of Natal:
121 blue whales, 177 fin whales, 37 humpbacks, 49 seis = 232 estimated blue whales.
Catch 15,845 barrels = 68.3 — — —

E. The Coast of Chile:
102 blue whales, 224 fin whales, 19 humpbacks = 222 estimated blue whales.
Catch 12,500 barrels = 56.3 — — —

F. Mexico:
239 blue whales, 498 humpbacks, 34 seis, 42 greys = 453 estimated blue whales.
Catch 29,000 barrels = 64 — — —

Northern Fields:

In comparing the quantity of oil yielded by a whale in the Northern Seas with that yielded by the same species in the Southern Seas it must be remembered that whales in the Southern Seas are on an average considerably larger than those in the North. These conditions were minutely illustrated in a previous section of this work.

A. Coast of Norway:
376 fin whales, 3 humpbacks, 188 seis = 220 estimated blue whales.
Catch 12,959 barrels = 58.9 barrels per blue whale unit.

B. Færoe Islands:
1 blue whale, 156 fin whales, 3 humpbacks, 9 seis = 82 estimated blue whales.
Catch 4,700 barrels = 57.3 — — —

C. North Spain:
622 fin whales = 311 estimated blue whales.
Catch 18,200 barrels = 58.5 barrels per blue whale unit.

D. South Spain:
242 fin whales = 121 estimated blue whales.
Catch 6,897 barrels = 57 — — —

E. Portugal:
231 fin whales = 115 estimated blue whales.
Catch 5,750 barrels = 50 — — —

Similar calculations for the Southern Season 1924—25 and for the Summer Season 1925.

Southern Seas:

A. South Georgia:
Company I: 590 blue whales, 390 fin whales, 49 humpbacks = 805 estimated blue whales.
Catch 71,650 barrels = 89 barrels per blue whale unit.
— II: 531 blue whales, 228 fin whales, 31 humpbacks = 657 estimated blue whales.
Catch 59,350 barrels = 90.3 — — —
— III: 454 blue whales, 381 fin whales, 23 humpbacks = 653 estimated blue whales.
Catch 50,500 barrels = 77.3 — — —
Average for South Georgia 85.8 barrels per blue whale unit.

B. South Shetlands:
Company I: 144 blue whales, 171 fin whales, 4 humpbacks = 231 estimated blue whales.
Catch 21,300 barrels = 92.2 barrels per blue whale unit.
— II: 229 blue whales, 318 fin whales, 5 humpbacks = 390 estimated blue whales.
Catch 33,700 barrels = 86.4 — — —
— III: 131 blue whales, 161 fin whales = 212 estimated blue whales.
Catch 19,150 barrels = 90.3 — — —
— IV: 156 blue whales, 123 fin whales, 21 humpbacks = 226 estimated blue whales.
Catch 20,550 barrels = 90.9 — — —
— V: 272 blue whales, 334 fin whales, 6 humpbacks = 441 estimated blue whales.
Catch 37,700 barrels = 85.5 — — —
— VI: 190 blue whales, 231 fin whales, 2 humpbacks = 306 estimated blue whales.
Catch 26,500 barrels = 86.6 — — —
— VII: 142 blue whales, 149 fin whales, 12 humpbacks = 221 estimated blue whales.
Catch 20,600 barrels = 93.2 — — —
Average for South Shetlands 88.6 barrels per blue whale unit.
Average for the Southern Seas 87.2 barrels per blue whale unit.

Tropical and temperate Fields:

A. Walvis Bay:
223 blue whales, 37 fin whales, 60 humpbacks = 265 estimated blue whales.
Catch 12,760 barrels = 48.2 barrels per blue whale unit.

B. Angola:
135 blue whales, 42 fin whales, 17 humpbacks, 50 seis, 17 right = 186 estimated blue whales.
Catch 5,580 barrels = 30 — — —

C. Cape Blanco:
6 blue whales, 59 fin whales, 1 humpback, 38 seis = 42 estimated blue whales.
Catch 2,440 barrels = 58 — — —

D. Saldanha Bay:
430 blue whales, 414 fin whales, 6 humpbacks, 21 seis = 643 estimated blue whales.
Catch 29,488 barrels = 45.9 — — —

E. The Coast of Chile:
76 blue whales, 82 fin whales, 17 humpbacks, 7 rights = 130 estimated blue whales.
Catch 7,770 barrels = 59.7 — — —

F. Mexico:
95 blue whales, 1 fin whale, 235 humpbacks, 20 seis, 82 greys = 212 estimated blue whales.
Catch 16,000 barrels = 70.8 — — —

The Norwegian Sea:

3 blue whales, 502 fin whales, 200 seis, 5 humpbacks = 290 estimated blue whales.
Catch 18,386 barrels = 63.4 barrels per blue whale unit.

These figures give a very distinct picture of the value of the various species of whale in the different parts of the world where whaling is carried on.

In order further to elucidate the conditions in two most important fields, namely South Georgia and South Shetlands, I will include one more season, namely 1923—24.

The fact is that it has been found that the stock of whales in certain years may be specially fat, in other years less fat in one or both of these fields. In the season 1925—26 and 1924—25 there were thus comparatively fewer fat whales at South Georgia, whilst at South Shetlands they were better than the average.

The season 1923—24 shewed the reverse conditions. The whales were unusually fat at South Georgia and at South Shetlands the whales were less fat than the average.

A calculation of the two fields for that season is therefore of interest.

Calculation of the yield of oil per whale. Southern Seas: Season 1923—24.

A. South Georgia:

Company I: 256 blue whales, 247 fin whales, 17 humpbacks, 6 seis = 387 estimated blue whales.
Catch 34,202 barrels = 88.4 barrels per blue whale unit.

— II: 439 blue whales, 259 fin whales, 39 humpbacks, 52 seis = 593 estimated blue whales.
Catch 52,260 barrels = 89.6 — — —

— III: 289 blue whales, 154 fin whales, 19 humpbacks, 39 seis = 380 estimated blue whales.
Catch 34,229 barrels = 90.1 — — —

— IV: 288 blue whales, 218 fin whales, 15 humpbacks, 6 seis = 404 estimated blue whales.
Catch 35,713 barrels = 88.4 — — —

— V: 359 blue whales, 260 fin whales, 16 humpbacks, 53 seis = 504 estimated blue whales.
Catch 46,158 barrels = 91.6 — — —

Average for South Georgia 89.3 barrels per blue whale unit.

B. South Shetlands:

Company I: 129 blue whales, 131 fin whales, 3 humpbacks = 196 estimated blue whales.
Catch 15,420 barrels = 78.7 barrels per blue whale unit.

— II: 82 blue whales, 93 fin whales, 23 humpbacks = 138 estimated blue whales.
Catch 11,400 barrels = 82.6 — — —

— III: 103 blue whales, 96 fin whales, 15 humpbacks, 7 rights = 164 estimated blue whales.
Catch 14,700 barrels = 89.6 — — —

— IV: 132 blue whales, 235 fin whales, 5 humpbacks, 2 seis = 252 estimated blue whales.
Catch 19,970 barrels = 79.2 — — —

— V: 233 blue whales, 286 fin whales, 8 humpbacks, 4 rights = 383 estimated blue whales.
Catch 31,522 barrels = 82.3 — — —

— VI: 142 blue whales, 84 fin whales, 4 humpbacks = 186 estimated blue whales.
Catch 15,571 barrels = 83.7 — — —

— VII: 121 blue whales, 165 fin whales, 4 humpbacks = 205 estimated blue whales.
Catch 15,800 barrels = 77.1 — — —

Average for South Shetlands 81.6 barrels per blue whale unit.
Average for the Southern Seas 86.2 barrels per blue whale unit.

If we carefully consider the above statistics, it is difficult to doubt that the basis of the calculations: 1 blue whale = 2 fin whales = 2.5 humpbacks = 6 seis is fairly correct. The experience during many years of practical whalers is confirmed to a high degree by the comparative calculations given here. As will be seen, the relation between the various companies which carry on whaling in uniform fields is surprisingly even, even if the catch consists of more or less fin whales in proportion to blue whales, and if there is now and then an apparently large difference, it is almost always possible to shew that this is the result of a greater or less average length of the whales caught. This can be checked by means of the measurement statistics. It should, however, be observed that the place in numerical order of the same company in all these tables is not always the same. The difference in production per estimated blue whale can likewise in certain cases be explained by the capacity of the station or factory concerned to utilise the raw materials to best advantage. The difference between the capacity of the different stations, however, is not great, since all stations are now very well equipped.

I, therefore, suggest that on the whole the basis of the calculations is correct, and that on that foundation it is possible to undertake the comparative calculations which are given above. It appears from those calculations that in the various fields a greatly varying yield is obtained from the animals caught, so different that whaling should not be carried on in certain fields since, to a very large extent, the catch consists of young, undeveloped, lean, and in some cases sick animals.

In the whaling fields in the Southern Seas it is possible to shew from one year to another that the various species of whales give the following yield:

Blue whales	84—87	barrels	of oil.
Fin whales	42—43	—	—
Humpbacks	33—34	—	—
Seis	14—15	—	—

The yield may of course vary greatly on account of the different size and degree of fat of the animals, but the average is that given above, and it can be regarded as quite reliable.

In the Northern Whaling Fields the various species of whale give the following average yield:

Blue whales	60—64	barrels	of oil.
Fin whales	30—32	—	—
Seis	10—11	—	—

The humpback occurs so rarely that it cannot be included.

All measurements, however, shew that the whale in the Northern Fields is considerably smaller than that in the South.

The animals never attain the huge size found in the Southern Seas and it is, therefore, natural that the yield of the northern whale must be correspondingly less. Taking this into consideration it must, therefore, from an economic point of view be just as justifiable to carry on whaling in the Northern Seas as in the South. This, however, cannot be said regarding the whaling operations which take place in certain more tropical waters, where the conditions to a greater or less extent are such that the animals are killed during a period and under conditions which render them of small value from an economic point of view.

As previously stated, the humpback forms an exception, since in tropical and more temperate waters it gives a yield which fully justifies the catch of that species of animal. The same also applies to the sperm whale which has its real home in temperate and tropical waters. The catch of this species of animal, however, plays no very important part at the present time.

VI.

Measurements of Foetuses in the Southern Seas.

The measurements of foetuses dealt with here come from all the whaling fields of the Southern Seas, South Georgia, South Shetlands and South Orkneys. They include statistics from the "Tönsberg Hvalfangeri" at South Georgia for the seasons 1920—1921 and for 1921—1922, and also from all Norwegian Whaling Companies in the said Southern Fields for the seasons 1922—1923, 1923—1924 and 1924—1925. These statistics comprise in all 593 measurements of blue whale foetuses and 462 measurements of fin whale foetuses. The material at our disposal is thus very considerable. In addition to that submitted here there exist a considerable number of measurements of foetuses from these regions, but I consider that the material published is sufficient to elucidate certain conditions of interest regarding the breeding of blue whales and fin whales.

In the tables of measurement statistics here published the measurements are arranged according to the time of the year in which the mother animal was captured. I have further given the length of the mother animal, as that is also of interest regarding the questions which are here to be elucidated. The measurements of both mother animal and fetus are given in Norwegian feet and inches, and as regards the foetus these have been recalculated into millimetres.

I will first give all the measurements of foetal blue whales (see Table 29 pp. 50—54).

From these statistics it will soon be observed that foetuses of the most varying sizes occur, practically speaking throughout, the whaling season. Thus we

Table 29. Blue Whale Foetuses.

Measured in the Southern Seas, arranged in accordance with the time of the year when the mother animal was captured. Seasons, 1922—1923, 1923–1924, 1924–1925, and also in the case of the "Tönsberg Whaling Company" 1920—1921, 1921—1922.

Date	Length			Date	Length			Date	Length		
	Mother	Foetus			Mother	Foetus			Mother	Foetus	
	feet	feet	mm.		feet	feet	mm.		feet	feet	mm.
12/10 1923	92′	4′	1256	14/11 1922	80′	8′	2512	26/11 1923	79′	4′	1256
13/10 1924	92′	3′ 3″	1020	— 1924	85′	3′	942	— —	84′	5′	1570
16/10 —	95′	3′	942	15/11 1922	89′	8′	2512	— 1924	82′	5′ 6″	1727
21/10 1923	75′	11′	3454	— 1923	89′	5′	1570	27/11 —	70′	5′	1570
— 1924	100′	17′	5338	— —	89′	7′	2198	— —	72′	4′ 8″	1465
22/10 —	83′	5′	1570	16/11 —	87′	1′ 8″	523	— —	84′	8′	2512
— —	84′	14′	4396	17/11 1922	84′	6′	1884	28/11 1922	95′	4′	1256
— —	84′	1′ 2″	366	— 1924	81′	16′	5024	— 1923	84′	6′	1884
24/10 —	87′	2′10″	889	18/11 1922	86′	4′	1256	— 1924	80′	7′	2198
25/10 —	83′	4′	1256	— 1923	87′	4′	1256			6′	1884
— —	83′	3′	942	19/11 1924	82′	6′	1884	30/11 1923	83′	6′	1884
27/10 1923	90′	5′	1570	20/11 1922	95′	5′	1570	— 1924	95′	5′	1570
— 1924	83′	3′	942	— 1923	81′	2′	628	29/11 1922	75′	4′ 9″	1491
28/10 1923	85′	17′	5338	— —	90′	3′	942	— 1923	84′	6′	1884
— 1924	78′	2′ 6″	785	— —	87′	5′	1570	30/11 1922	85′	7′	2198
— —	80′	2′10″	889	21/11 —	80′	6′	1884	— 1923	76′	6′	1884
— —	77′	0′10″	261	— —	84′	4′ 6″	1413	— —	91′	5′	1570
31/10 1923	84′	6′ 6″	2041	— —	87′	6′	1884	1/12 1923	82′	10′	3140
— 1924	91′	4′ 6″	1413	— —	87′	3′	942	— 1922	81′	5′	1570
— —	86′	2′10″	889	— 1924	90′	1′10″	575	2/12 —	85′	18′	5652
— —	91′	7′	2198	— —	69′	3′	942	— —	73′	9′	2826
1/11 1924	93′	6′	1884	22/11 1922	85′	5′	1570	3/12 1923	89′	4′ 6″	1413
2/11 —	81′	6′	1884	— —	92′	9′	2826	— —	84′	9′	2826
3/11 1923	90′	4′	1256	— 1923	71′	3′ 6″	1099	— —	89′	7′	2198
— 1924	80′	16′	5024	22/11 —	68′	4′ 6″	1413	— —	83′	6′	1884
5/11 1923	83′	5′	1570	23/11 1920	88′	4′	1256	4/12 1922	87′	6′	1884
— —	81′	2′	628	— 1923	90′	7′	2198	— 1923	83′	5′	1570
6/11 —	88′	5′	1570	— —	82′	7′	2198	— —	89′	6′	1884
7/11 —	78′	3′ 3″	1020	24/11 —	91′	8′	2512	5/12 —	85′	6′	1884
— —	95′	3′	942	— 1924	81′	1′ 4″	418	— 1924	90′	6′	1884
9/11 —	83′	2′	628	— —	85′	5′	1570	— —	88′	6′	1884
10/11 1924	89′	4′	1256	— —	90′	7′	2198	6/12 1922	90′	6′	1884
— —	85′	2′ 6″	785	— —	65′	5′	1570	— 1923	90′	10′	3140
12/11 —	74′	4′	1256	25/11 1923	80′	4′	1256	— 1924	85′	17′	5338
13/11 —	87′	9′	2826	— —	81′	16′	5024	7/12 1923	88′	3′	942
— —	85′	6′10″	2145	— 1924	86′	7′	2198	— —	87′	5′	1570
— —	84′	4′10″	1517	26/11 1922	79′	7′	2198	— 1924	90′	7′	2198
14/11 1922	80′	3′	942	— 1923	84′	12′	3768	8/12 1922	94′	5′	1570
— —	90′	3′	942	— —	84′	3′	942	— 1923	85′	8′	2512

Date	Length			Date	Length			Date	Length		
	Mother	Foetus			Mother	Foetus			Mother	Foetus	
	feet	feet	mm.		feet	feet	mm.		feet	feet	mm.
9/12 1923	82′	6′	1884	18/12 1923	78′	10′	3140	23/12 1924	95′	13′	4082
— —	83′	7′ 6″	2355	— —	69′	5′	1570	— —	90′	2′	628
10/12 1922	88′	11′	3454	— —	78′	3′	942	24/12 1922	74′	12′	3768
— 1923	88′	7′	2198	— —	90′	12′	3768	— 1923	78′	6′	1884
— 1924	80′	1′ 8″	523	— —	83′	6′	1884	— —	80′	8′	2512
11/12 1922	96′	9′	2826	— —	90′	1′	314	— —	91′	10′	3140
— 1923	82′	3′	942	— 1924	85′	4′	1256	— —	86′	8′	2512
12/12 1922	85′	11′	3454	19/12 1923	76′	7′	2198	— —	89′	4′	1256
— —	92′	9′	2826	— 1924	90′	3′	942	25/12 1923	87′	7′	2198
— 1923	77′	6′ 6″	2041	— —	81′	5′	1570	— —	88′	6′	1884
— —	82′	2′ 6″	785	20/12 1922	74′	6′	1884	26/12 1922	83′	7′	2198
— —	85′	7′	2198	— 1923	76′	7′ 6″	2355	— 1923	80′	9′	2826
— —	82′	4′	1256	— —	79′	10′ 6″	3297	27/12 1923	82′	0′10″	261
— 1924	84′	8′	2512	— —	75′	5′	1570	— —	83′	4′	1256
— —	82′	4′	1256	— —	81′	0′10″	261	— 1924	84′	3′	942
		8′	2512	— —	83′	18′	5652	— —	101′	8′	2512
— —	93′	7′	2198	— —	95′	4′	1256	— —	83′	10′	3140
— —	88′	10′	3140	— —	90′	10′	3140	— —	77′	7′	2198
13/12 1922	80′	5′	1570	— —	94′	5′	1570	28/12 1924	82′	3′	942
— —	76′	3′	942	— 1924	80′	11′ 6″	3611	— —	93′	18′	5652
— 1923	78′	3′ 6″	1099	— —	75′	4′ 6″	1413	— 1922	85′	15′	4710
— —	84′	12′	3768	— —	85′	10′	3140	— —	85′	16′	5024
— 1924	71′	7′	2198	— —	89′	2′	628	— 1923	86′	12′	3768
— —	94′	3′	942	— —	85′	15′	4710	— —	87′	7′	2198
14/12 1922	77′	6′	1884	21/12 1922	71′	15′	4710	— —	80′	4′	1256
— 1923	85′	3′	942	— 1923	86′	5′	1570	— —	87′	7′	2198
15/12 1921	90′	4′	1256	— —	74′	8′	2512	— —	87′	6′	1884
— 1922	88′	10′	3140	— 1924	83′	8′	2512	29/12 —	76′	7′	2198
— —	87′	5′	1570	22/12 1922	87′	7′	2198	— —	85′	4′	1256
— —	80′	6′	1884	— —	74′	8′	2512	— 1924	88′	4′	1256
— 1924	91′	9′	2826	— —	71′	15′	4710	— —	76′	2′ 6″	785
— —	85′	8′	2512	— 1923	81′	11′	3454	30/12 1923	82′	10′	3140
— —	82′	11′ 6″	3611	— —	89′	12′	3768	— —	86′	5′ 6″	1727
— —	81′	4′	1256	— —	84′	2′ 6″	785	— —	85′	12′	3768
16/12 1922	80′	8′	2512	— —	85′	9′	2826	— —	89′	9′	2826
— —	80′	7′	2198	— —	78′	6′	1884	— —	77′	6′	1884
— 1924	85′	10′	3140	— —	84′	7′	2198	— —	80′	4′	1256
— —	88′	4′	1256	— 1924	97′	8′	2512	— —	83′	12′	3768
17/12 1922	79′	4′	1256	23/12 1923	85′	8′	2512	— —	89′	7′	2198
— —	82′	7′	2198	— —	90′	10′	3140	— 1924	93′	12′	3768
— 1923	82′	8′	2512	— —	79′	5′	1570	— —	83′	4′	1256
18/12 —	83′	7′	2198	— —	72′	5′	1570	— —	75′	3′	942
— —	83′	4′ 6″	1413	— 1924	80′	12′	3768	— —	93′	10′	3140

Date	Length			Date	Length			Date	Length		
	Mother	Foetus			Mother	Foetus			Mother	Foetus	
	feet	feet	mm.		feet	feet	mm.		feet	feet	mm.
31/12 1922	80′	10′	3140	7/1 1924	86′	7′	2198	16/1 1924	80′	8′	2512
— —	80′	5′	1570	8/1 —	80′	9′	2826	— 1925	85′	12′	3768
— 1923	85′	10′	3140	— —	84′	4′	1256	— —	80′	8′	2512
— —	80′	6′ 6″	2041	— —	82′	10′	3140	17/1 —	83′	18′	5652
— 1924	82′	3′	942	— —	89′	6′ 6″	2041	— —	80′	6′	1884
2/1 1923	83′	2′	628	— —	82′	4′	1256	18/1 1923	86′	6′	1884
— —	81′	7′	2198	— —	79′	6′	1884	— —	79′	10′	3140
— 1924	83′	17′	5338	— —	86′	7′	2198	— —	75′	12′	3768
— —	87′	7′	2198	— 1925	90′	12′	3768	— —	72′	4′	1256
— 1925	92′	11′	3454	— —	83′	10′	3140	— 1925	80′	4′	1256
— —	84′	9′	2826	— —	82′	10′	3140	19/1 1923	88′	10′	3140
3/1 1923	81′	6′	1884	— —	91′	5′	1570	— —	82′	4′	1256
— 1924	80′	7′	2198	9/1 1923	82′	10′	3140	— —	84′	10′	3140
— —	82′	12′	3768	— 1924	80′	6′	1884	— 1925	83′	10′	3140
— —	86′	8′	2512	— 1925	83′	5′	1570	20/1 1924	80′	7′	2198
— —	92′	9′	2826	— —	90′	6′	1884	— —	83′	11′	3454
— 1925	85′	6′	1884	— —	87′	9′	2826	— —	80′	7′	2198
4/1 1922	95′	4′	1256	10/1 1923	78′	4′	1256	— —	85′	5′	1570
— —	86′	8′	2512	— —	80′	7′	2198	21/1 1923	92′	10′	3140
— 1923	72′	6′	1884	— 1924	80′	7′	2198	— 1924	82′	3′	942
— 1924	80′	6′	1884	— —	80′	3′	942	— 1925	80′	10′	3140
— —	78′	9′	2826	11/1 1923	80′	3′	942				
— —	80′	4′	1256	— 1925	82′	7′	2198	— —	71′	9′6″	2983
— —	84′	4′	1256	12/1 1922	95′	8′	2512			8′	2512
— 1925	87′	8′	2512	— 1923	86′	8′	2512	22/1 1922	95′	8′	2512
5/1 1923	86′	7′	2198	13/1 1922	91′	12′	3768	— 1924	85′	14′	4396
— —	86′	7′	2198	— —	88′	9′	2826	— 1925	95′	12′	3768
— 1924	88′	8′	2512			9′	2826	23/1 1922	90′	8′	2512
— —	84′	5′	1570	— —	91′	8′	2512	— —	83′	15′	4710
— 1925	79′	8′	2512	— 1923	72′	8′	2512	— —	90′	7′	2198
— —	74′	9′	2826	— 1924	80′	9′	2826	24/1 1924	82′	16′	5024
— —	85′	8′	2512	— —	93′	14′	4396	— 1925	88′	20′	6280
— —	89′	5′	1570	— —	88′	17′	5338	— —	87′	7′ 6″	2355
— —	85′	15′	4710	— 1925	85′	7′	2198	25/1 1923	86′	8′	2512
6/1 1923	84′	6′	1884	14/1 1924	92′	10′	3140	— —	91′	4′	1256
— 1925	84′	4′	1256	— —	86′	10′	3140	— 1924	81′	10′ 6″	3297
— —	97′	7′	2198	15/1 —	87′	5′	1570	— —	72′	2′ 6″	785
— —	89′	14′	4396	— 1925	80′	5′	1570	26/1 1921	95′	8′	2512
7/1 1923	69′	3′	942	16/1 1922	93′	5′	1570	— 1923	73′	6′	1884
— —	80′	10′	3140	— —	84′	10′	3140	— 1925	85′	19′	5966
— —	80′	6′	1884	— 1923	76′	4′	1256	27/1 1922	88′	10′	3140
— 1924	90′	18′	5652	— —	85′	9′	2826	— —	90′	8′	2512
— —	90′	10′	3140	— —	86′	12′	3768	— 1923	86′	12′	3768
									91′	12′	3768

Date	Length			Date	Length			Date	Length		
	Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.
27/1 1924	70′	8′ 6″	2669	8/2 1923	95′	12′	3768	25/2 1925	84′	4′	1256
— 1925	83′	8′	2512	— 1925	82′	6′	1884	26/2 1923	95′	19′	5966
28/1 1922	95′	16′	5024	9/2 1923	80′	7′	2198	— —	84′	6′	1884
— 1924	88′	14′	4396	— 1925	83′	17′	5338	— 1924	80′	9′	2826
— —	87′	10′ 6″	3297	10/2 1923	88′	14′	4396	— 1925	79′	12′	3768
— —	83′	5′	1570	— 1925	84′	4′	1256	— —	87′	8′ 6″	2669
29/1 1923	85′	7′	2198	— —	87′	15′	4710	27/2 1922	86′	15′	4710
— 1924	85′	8′	2512	11/2 1923	68′	5′	1570	— 1923	84′	9′	2826
— 1925	90′	10′	3140	— 1925	77′	5′	1570	— —	85′	4′	1256
30/1 —	92′	6′	1884	12/2 1923	87′	5′	1570	— —	90′	18′	5652
31/1 1922	87′	13′	4082	— —	85′	18′	5652	1/3 1922	90′	18′	5652
— 1923	85′	17′	5338	— —	87′	10′	3140	— —	93′	14′	4396
— —	90′	6′	1884	— —	78′	5′	1570	— 1923	80′	10′	3140
— 1924	90′	12′	3768	13/2 1922	90′	16′	5024	— 1925	80′	11′	3454
— —	90′	9′	2826	— 1923	63′	12′	3768	2/3 1922	93′	17′	5338
1/2 1923	70′	6′	1884	15/2 1922	91′	14′	4396	— 1923	84′	12′	3768
— 1925	84′	7′	2198	— 1923	78′	17′	5338	— —	88′	12′	3768
2/2 1922	90′	13′	4082	— —	90′	8′	2512	3/3 1923	87′	10′	3140
— 1923	86′	7′	2198	— —	85′	12′	3768	— —	80′	21′	6594
— 1924	90′	16′	5024	16/2 1925	80′	7′	2198	— 1925	88′	8′	2512
3/2 —	90′	9′ 6″	2983	— —	80′	15′	4710	— —	88′	18′	5652
— —	92′	5′	1570	— —	90′	15′	4710	4/3 1924	90′	20′	6280
— 1925	90′	20′	6280	— —	80′	7′	2198	5/3 —	85′	12′	3768
— —	75′	12′	3768	— —	80′	9′	2826	— —	82′	10′	3140
4/2 1922	89′	7′	2198	17/2 1923	80′	5′	1570	6/3 1922	86′	17′	5338
— —	89′	12′	3768	— —	87′	12′	3768	— —	85′	7′	2198
— 1923	79′	14′	4396	— —	85′	11′	3454	— 1924	81′	7′	2198
— 1925	83′	13′	4082	— —	74′	7′	2198	— 1925	72′	5′	1570
5/2 1923	80′	6′	1884	— 1924	79′	12′	3768	7/3 1923	89′	8′	2512
— —	89′	8′	2512	18/2 1923	86′	11′	3454	— 1924	83′	14′	4396
6/2 1922	81′	9′	2826	20/2 1925	90′	14′	4396	8/3 1923	73′	8′	2512
— —	97′	15′	4710	— —	89′	17′	5338	— —	92′	19′	5966
— 1924	83′	15′	4710	21/2 1923	82′	18′	5652	— 1924	86′	12′	3768
— 1925	83′	8′	2512	— —	89′	15′	4710	9/3 1923	90′	17′	5338
— —	90′	10′	3140	— 1924	86′	17′	5338	— —	80′	18′	5652
— —	91′	8′	2512	22/2 1922	88′	10′	3140	— —	85′	15′	4710
— —	78′	15′	4710	— 1923	90′	14′	4396	10/3 1925	85′	22′	6908
— —	93′	7′	2198	23/2 —	93′	19′	5966	12/3 1921	82′	17′	5338
7/2 1923	66′	4′	1256	— 1925	76′	12′	3768	— 1925	88′	18′	5652
— —	91′	10′	3140	24/2 1923	78′	16′	5024	— —	77′	13′	4082
— 1925	78′	7′	2198	— 1925	84′	17′	5338	13/3 1922	74′	17′	5338
— —	78′	6′	1884	25/2 1923	84′	18′	5652	14/3 1923	90′	14′	4396
— —	86′	6′	1884	— —	82′	11′	3454	— 1922	85′	16′	5024

Date	Length			Date	Length			Date	Length		
	Mother	Foetus			Mother	Foetus			Mother	Foetus	
	feet	feet	mm.		feet	feet	mm.		feet	feet	mm.
15/3 1923	91′	20′	6280	27/3 1923	90′	12′	3768	7/4 1924	86′	18′	5652
— —	92′	5′	1570	— 1922	92′	18′	5652	— 1925	84′	10′	3140
16/3 1922	88′	14′	4396	28/3 1925	93′	10′	3140	8/4 1922	82′	17′	5338
— 1923	85′	16′	5024	29/3 1923	83′	16′	5024	— 1923	87′	12′	3768
17/3 —	81′	14′	4396	— 1925	87′	15′	4710	— —	89′	15′	4710
— 1924	80′	12′	3768	30/3 1923	82′	15′	4710	— 1925	88′	6′	1884
— 1925	95′	27′	8478	1/4 1922	93′	12′	3768	10/4 1922	87′	23′	7222
18/3 1923	80′	12′	3768	— —	73′	12′	3768	— —	74′	15′	4710
— —	88′	22′	6908	— 1925	86′	16′	5024	11/4 1925	90′	15′	4710
— —	83′	18′	5652	2/4 1923	76′	7′	2198	13/4 1924	82′	10′	3140
19/3 —	84′	8′	2512	— —	80′	9′	2826	— 1925	80′	14′	4396
— 1925	90′	19′	5966	— 1925	99′	13′	4082	15/4 —	91′	20′	6280
20/3 1923	66′	6′	1884	3/4 1923	86′	7′	2198	16/4 —	82′	15′	4710
— —	84′	9′	2826	— —	78′	11′	3454	19/4 —	85′	16′	5024
— —	80′	7′	2198	— —	96′	6′	1884	20/4 —	91′	25′	7850
20/3 1925	88′	17′	5338	— 1924	80′	15′	4710	22/4 —	81′	15′	4710
21/3 1923	87′	18′	5652	4/4 1921	85′	10′	3140	23/4 1923	80′	15′	4710
— 1925	95′	18′	5652	— 1923	86′	12′	3768	25/4 1925	80′	9′	2826
22/3 1923	84′	9′	2826	— —	84′	12′	3768	26/4 —	82′	7′	2198
— 1925	82′	13′	4082	— 1925	82′	9′	2826	27/4 —	92′	12′	3768
23/3 1922	86′	18′	5652	5/4 1923	87′	9′	2826	28/4 —	90′	14′	4396
— —	97′	15′	4710	— —	86′	20′	6280	— —	85′	9′	2826
— 1925	88′	15′	4710	— —	80′	16′	5024	2/5 —	83′	14′	4396
— —	89′	25′	7850	— —	84′	8′	2512	4/5 1923	85′	23′	7222
24/3 1922	82′	20′	6280	— —	92′	27′	8478	7/5 1925	92′	5′	1570
25/3 1923	88′	17′	5338	6/4 —	84′	8′	2512	11/5 1922	74′	20′	6280
— —	85′	16′	5024	— —	86′	12′	3768	21/5 1923	88′	24′	7536
— —	87′	10′	3140	— —	88′	24′	7536				
26/3 1921	85′	17′	5338	— 1925	92′	15′	4710	Total 593 blue whale foetuses measured.			
27/3 1923	86′	10′	3140	— —	81′	18′	5652				
— —	85′	17′	5338	7/4 1923	86′	12′	3768				

find in the month of October one foetus 17 feet in length and another 10 inches on the same day. We find in November a number of foetuses 16 feet in length almost simultaneously with foetuses of 2 feet and less.

In December	the	largest	foetus	was	18	feet	and	the	smallest	10 inches
- January	-	—	—	—	20	—	—	-	—	2 feet
- February	-	—	—	—	20	—	—	-	—	4 —
- March	-	—	—	—	27	—	—	-	—	5 —
- April	-	—	—	—	27	—	—	-	—	6 —
- May	-	—	—	—	24	—	—	-	—	5 —

It appears from the above that the blue whale has no briefly limited period of breeding, but that breeding may take place practically throughout the year.

If, however, we study the figures more closely, we find that during the first months of whaling season the number of small foetuses is much larger than that towards the end of the season. We further find that the number of large foetuses, which at the beginning of the season may occur in small numbers, by degrees increases during the season. Thus in April and May quite small foetuses are no longer found in the figures, although in October and November they were very common.

In order further to elucidate these conditions I have from the large amount of material containing measurements of all blue whale foetuses for the years mentioned above, separated the measurements for each particular year, so that I obtained one series of measurements for the seasons 1920—1921 and 1921—1922, one series for the season 1922—1923, one for 1923—1924 and one for 1924—1925.

I combined the seasons 1920—1921 and 1921—1922 into one series because I had so few measurements from those seasons that I could not expect to obtain any reliable idea of the increase in the size of the foetus during the season.

In that manner there occur four different series of measurements.

First Series:	measurements from	1920—1921 and 1921—1922	51	foetuses
Second —	—	— 1922—1923.....	167	—
Third —	—	— 1923—1924.....	185	—
Fourth —	—	— 1924—1925.....	190	—
		Total...	593	foetuses

I then undertook a calculation of the average size of the foetuses for each particular month during the whaling season in order to investigate whether there would occur a definite curve of increase. In the next place it was of the greatest interest to see whether these curves would shew the same rise from year to year. The result of these calculations is as follows:

Calculation of the average size of the blue whale foetuses measured in the Southern Seas.

Calculation for the seasons 1920—1921 and 1921—1922:

In November.....	1	foetus,	average length	4	feet			= 1256 mm.
- December.....	1	—	—	4	—			= 1256 —
- January	19	foetuses	—	9	—	$4^2/_5$	inches	= 2940 —
- February	9	—	—	12	—	4	—	= 3873 —
- March	14	—	—	16	—	$^6/_7$	—	= 5047 —
- April	6	—	—	14	—	10	—	= 4658 —
- May.....	1	foetus	—	20	—			= 6280 —

Calculation for the season 1922—1923:

In November.....	14	foetuses,	average	length	6 feet	$1^1/_2$	inches	= 1923 mm.
- December.....	31	—	—	—	8 —	7	—	= 2695 —
- January	35	—	—	—	7 —	$4^4/_5$	—	= 2323 —
- February	36	—	—	—	10 —	$8^4/_5$	—	= 3369 —
- March	32	—	—	—	13 —	$3^3/_4$	—	= 4181 —
- April	17	—	—	—	11 —	$9^1/_5$	—	= 3694 —
- May.....	2	—	—	—	23 —	6	—	= 7379 —

Calculation for the season 1923—1924:

In October.....	5	foetuses,	average	length	8 feet	$8^2/_5$	inches	= 2731 mm.
- November.....	34	—	—	—	4 —	$11^1/_2$	—	= 1556 —
- December.....	80	—	—	—	6 —	$9^9/_{10}$	—	= 2142 —
- January	48	—	—	—	8 —	$6^3/_8$	—	= 2679 —
- February.....	7	—	—	—	11 —	$11^1/_7$	—	= 3744 —
- March	7	—	—	—	13 —	$10^2/_7$	—	= 4350 —
- April	4	—	—	—	14 —	6	—	= 4553 —

Calculation for the season 1924—1925:

In October.....	15	foetuses,	average	length	5 feet	$^1/_2$	inches	= 1583 mm.
- November.....	25	—	—	—	6 —	$1^1/_2$	—	= 1923 —
- December.....	44	—	—	—	7 —	$2^1/_3$	—	= 2259 —
- January	37	—	—	—	8 —	11	—	= 2799 —
- February	29	—	—	—	10 —	$9^1/_2$	—	= 3282 —
- March	17	—	—	—	16 —	$3^1/_2$	—	= 5115 —
- April	20	—	—	—	14 —	3	—	= 4474 —
- May.....	2	—	—	—	9 —	6	—	= 2983 —

The average figures found here are shewn in the following curves:

Figure 18. Average size of blue whale foetuses in the Southern Seas.

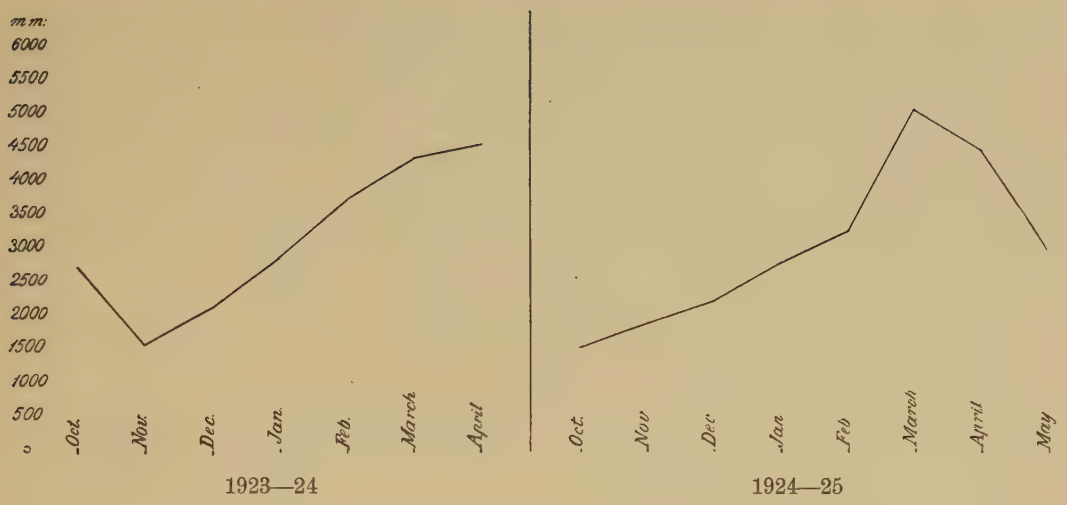

Figure 19. Average size of blue whale foetuses in the Southern Seas.

These curves shew two extremely important conditions:

1) The curve rises, and on the whole the rise is remarkably even. It is, however, to be expected that with a comparatively small number of measurements of foetuses we must be prepared to find that there occur in the curve either slight falls or irregular rises. It is also found that where slight irregularities occur in the curves, these are as a rule in months where comparatively few measurements were made during the whaling season in question. It is thus easier to obtain chance results.

It will thus be observed that when, for instance, in the season 1923—1924 the average length of the foetus for the month of October is considerably larger than that for November, this is due to the circumstance that only five measurements are available for October, of which two were 11 and 17 feet respectively. It is obvious that these increased the average to an abnormal extent.

On the other hand in the season 1924—1925 the average size of the foetus in the month of May was much less than in April. It must be observed that only two measurements are available for May and these by chance are both below the general average measurement.

In spite of these and similar slight irregularities it is shewn, however, by this relatively abundant material that, on the whole, the average size of the whale foetus grows during the whaling season in the Southern seas, and that this growth is somewhat regular.

The result of this is that in spite of the fact that the blue whale appears to breed at all times of the year, the majority of female blue whale have a more limited breeding season, restricted to a period of some few months.

2) It further appears from the series of measurements given that the curve on the whole is the same year after year. If we disregard the scanty measurements of the month of October, the curve begins in November with an average size of 4—6 feet, increasing towards March to 13—16 feet. In April the average size has a tendency to decrease, but this has an entirely natural explanation. In the Southern Whaling Fields the autumn sets in with violent storms and rough seas. The towing of the slaughtered animals often takes place over great distances and the female whale, which at that time is in many cases far pregnant, gives birth to its foetus whilst being towed. A number of the largest foetuses are thus never measured and the figure giving the average size may prove to be smaller than that for the previous month.

In order to collect, as far as possible, the somewhat scattered ideas conveyed by the series of measurements given, I have combined the whole material into one unit in order thereby to obtain the clearest possible picture of the conditions of foetal development of the blue whale. We then have the following average figures for each month:

In October.....	21	foetuses,	average	length	5	feet	$8^{7}/_{10}$	inches	=	1779 mm
- November.....	74	—	—	—	5	—	$6^{7}/_{10}$	—	=	1745 —
- December.....	156	—	—	—	7	—	$3^{1}/_{10}$	—	=	2279 —
- January	139	—	—	—	8	—	6	—	=	2679 —
- February	81	—	—	—	10	—	11	—	=	3427 —
- March	70	—	—	—	14	—	$4^{6}/_{10}$	—	=	4515 —
- April	47	—	—	—	13	—	$5^{4}/_{10}$	—	=	4222 —
- May.....	5	—	—	—	17	—	$2^{4}/_{10}$	—	=	5400 —

If, on the basis of many years knowledge of practical whaling and of the manner in which it is carried out and with knowledge of the conditions in which these measurements are taken, we consider the final result of these measurements more closely, it is easy to object that the measurements are possibly not made with sufficient accuracy.

The majority of Norwegian companies carrying on whaling in South Shetlands work with floating factories. There is even one working at South Georgia. It is thus conceivable that these measurements of foetuses are difficult to make with the same accuracy on a floating factory as on a permanent station on shore. Owing to the conditions, it is more difficult to undertake thorough investigation on a floating factory. It appears that quite small foetuses are not found there at all. In all the measurements from the whaling fields at South Shetlands there appear far fewer gestating females than in the statistics from South Georgia. The permanent station at Deception, however, forms an exception, since the figures from that station contain relatively just as many measurements of foetuses as those from the permanent stations in South Georgia. On the other hand, from the floating

factory at South Georgia the percentage of foetus measurements is not greater than that from the floating factories at South Shetlands.

At permanent whaling stations it is easier to undertake investigations of every kind and with regard to the measurements of foetuses it is an undoubted fact that these are more valuable from the permanent stations of South Georgia and South Shetlands than from the floating factories of the same whaling fields.

In order to convey an idea of this, I have drawn up a special series of the blue whale fetuses measured at the permanent stations in South Georgia during the years 1921—1925. The series is based upon figures taken from the "Tönsberg Hvalfangeri" for the seasons 1921—1922, 1922—1923, 1923—1924 and 1924—1925, and upon figures from the "Vestfold Shore Station" for the season 1924—1925.

The measurements are given in full on pp. 60—62, and the calculated averages are as follows:

In October.....	17	foetuses,	average	length	3	feet	$7^1/_4$	inches	=	1131 mm.
- November.....	44	—	—	—	4	—	$7^1/_{15}$	—	=	1441 —
- December.....	95	—	—	—	6	—	$10^4/_5$	—	=	2165 —
- January	55	—	—	—	8	—	$11^1/_4$	—	=	2805 —
- February	32	—	—	—	12	—	$5^1/_4$	—	=	3904 —
- March	28	—	—	—	16	—	$^1/_{28}$	—	=	5025 —
- April	7	—	—	—	15	—	$3^3/_7$	—	=	4799 —
- May.....	3	—	—	—	17	—	4	—	=	5442 —
Total ...	281	blue whale foetuses.								

It can be assumed that the measurements in the last series are as exact as can reasonably be demanded. It can also be assumed that all the foetuses which were brought to the station were measured. It also appears that there is here a steadily rising curve from the very beginning of the whaling season to the latter half of the month of May.

The only irregularity shewn by this curve is that the average size of the foetuses for the month of April is less than that for the month of March. I have, however, already explained this irregularity as due to the fact that a number of the largest foetuses are lost whilst the whale is being towed, a condition which is most pronounced at a whaling field like South Georgia with its open, unprotected and stormy coast.

In the calculations hitherto employed a figure has been given shewing the average size of the blue whale foetuses in the Southern Seas each month of the whaling season. The measurements shew, however, that in each month of the whaling season there also occur large or smaller foetuses in greater or lesser numbers. It is, therefore, particularly interesting to supplement the average length of the foetuses measured by measurements of divergence, which shew how far the measurements are closely grouped about the respective averages, or whether there exists

Table 30. Blue Whale Foetuses.

Measured at South Georgia by the Tönsberg Whaling Company 1921—22—23—24—25, by Vestfold 1924—1925.

Date	Length			Date	Length			Date	Length		
	Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.
12/10 1923	92′	4′	1256	21/11 1923	87′	3′	942	12/12 1923	82′	2′ 6″	785
13/10 1924	92′	3′ 3″	1020	— 1924	90′	1′10″	575	— —	85′	7′	2198
16/10 —	95′	3′	942	22/11 1923	71′	3′ 6″	1099	— —	82′	4′	1256
22/10 —	83′	5′	1570	— —	68′	4′ 6″	1413			4′	1256
— —	84′	1′ 2″	366	23/11 1920	88′	4′	1256	— 1924	82′	8′	2512
24/10 —	87′	2′10″	889	— 1923	90′	7′	2198	— —	93′	7′	2198
25/10 —	83′	4′	1256	24/11 —	91′	8′	2512	— —	88′	10′	3140
— —	83′	3′	942	— 1924	81′	1′ 4″	418	13/12 1923	78′	3′ 6″	1099
27/10 1923	90′	5′	1570	— —	85′	5′	1570	— 1924	71′	7′	2198
— 1924	83′	3′	942	— —	90′	7′	2198	— —	94′	3′	942
28/10 —	78′	2′ 6″	785	25/11 1923	80′	4′	1256	14/12 1923	85′	3′	942
— —	80′	2′10″	889	— 1924	86′	7′	2198	— 1922	77′	6′	1884
— —	77′	0′10″	261	26/11 1923	84′	3′	942	15/12 1921	90′	4′	1256
31/10 1923	84′	6′ 6″	2041	— 1924	82′	5′ 6″	1727	— 1922	88′	10′	3140
— 1924	91′	4′ 6″	1413	27/11 —	70′	5′	1570	— —	87′	5′	1570
— —	86′	2′10″	889	— —	72′	4′ 8″	1465	— —	80′	6′	1884
— —	91′	7′	2198	— —	84′	8′	2512	— 1924	82′	11′ 6″	3611
1/11 —	93′	6′	1884	28/11 1922	95′	4′	1256	— —	81′	4′	1256
3/11 1923	90′	4′	1256	— 1923	84′	6′	1884	— —	91′	9′	2826
5/11 —	83′	5′	1570	30/11 —	76′	6′	1884	— —	85′	8′	2512
— —	81′	2′	628	— 1924	95′	5′	1570	16/12 —	85′	10′	3140
6/11 —	88′	5′	1570	2/12 1922	85′	18′	5652	— —	88′	4′	1256
7/11 —	78′	3′ 3″	1020	3/12 1923	89′	4′ 6″	1413	17/12 1923	82′	8′	2512
— —	95′	3′	942	— —	84′	9′	2826	18/12 —	83′	7′	2198
9/11 —	83′	2′	628	— —	83′	6′	1884	— —	83′	4′ 6″	1413
10/11 1924	85′	2′ 6″	785	4/12 1922	87′	6′	1884	— —	78′	10′	3140
12/11 —	74′	4′	1256	— 1923	83′	5′	1570	— 1924	85′	4′	1256
13/11 —	85′	6′10″	2145	— —	89′	6′	1884	19/12 —	90′	3′	942
— —	84′	4′10″	1517	5/12 1924	88′	6′	1884	— —	81′	5′	1570
14/11 1922	90′	3′	942	6/12 1922	90′	6′	1884	20/12 1923	76′	7′ 6″	2355
15/11 —	89′	8′	2512	8/12 —	94′	5′	1570	— —	79′	10′ 6″	3297
— 1923	89′	5′	1570	— 1923	85′	8′	2512	— —	75′	5′	1570
— —	89′	7′	2198	9/12 —	82′	6′	1884	— —	81′	0′10″	261
16/11 —	87′	1′ 8″	523	— —	83′	7′ 6″	2355	— —	95′	4′	1256
19/11 1924	82′	6′	1884	10/12 —	88′	7′	2198	— —	90′	10′	3140
20/11 1923	81′	2′	628	— 1924	80′	1′ 8″	523	— —	94′	5′	1570
— 1922	95′	5′	1570	11/12 1922	96′	9′	2826	— 1924	80′	11′ 6″	3611
21/11 1923	80′	6′	1884	12/12 —	85′	11′	3454	— —	75′	4′ 6″	1413
— —	84′	4′ 6″	1413	— —	92′	9′	2826	21/12 1923	86′	5′	1570
— —	87′	6′	1884	— 1923	77′	6′ 6″	2041	— —	74′	8′	2512

Date	Length			Date	Length			Date	Length		
	Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.
21/12 1924	83′	8′	2512	5/1 1922	88′	8′	2512	27/1 1925	83′	8′	2512
22/12 1922	87′	7′	2198	— —	84′	5′	1570	28/1 1922	95′	16′	5024
— —	74′	8′	2512	— 1925	85′	8′	2512	— 1924	88′	14′	4396
— 1923	81′	11′	3454	— —	89′	5′	1570	29/1 1923	85′	7′	2198
— —	89′	12′	3768	6/1 —	89′	14′	4396	31/1 —	90′	6′	1884
— —	84′	2′ 6″	785	7/1 1924	90′	10′	3140	— 1922	87′	13′	4082
— —	85′	9′	2826	8/1 1925	91′	5′	1570	2/2 —	90′	13′	4082
— 1924	97′	8′	2512	— 1923	80′	9′	2826	— 1924	90′	16′	5024
23/12 1923	85′	8′	2512	— 1925	82′	10′	3140	3/2 —	90′	9′ 6″	2983
— —	90′	10′	3140	12/1 1922	95′	8′	2512	— 1925	90′	20′	6280
— 1924	80′	12′	3768	— 1924	93′	14′	4396	4/2 1922	89′	7′	2198
— —	95′	13′	4082	13/1 1922	91′	12′	3768	— —	89′	12′	3768
— —	90′	2′	628	— —	88′	9′	2826	— 1925	83′	13′	4082
24/12 1923	78′	6′	1884	— —	91′	9′	2826	6/2 1922	81′	9′	2826
— —	80′	8′	2512			8′	2512	— —	97′	15′	4710
— —	91′	10′	3140	— 1924	80′	9′	2826	— 1925	91′	8′	2512
— —	86′	8′	2512	14/1 —	92′	10′	3140	— —	93′	7′	2198
— —	89′	4′	1256	16/1 1922	93′	5′	1570	7/2 1923	91′	10′	3140
25/12 —	87′	7′	2198	— —	84′	10′	3140	8/2 —	95′	12′	3768
— —	88′	6′	1884	— 1924	80′	8′	2512	9/2 1925	83′	17′	5338
27/12 —	82′	0′10″	261	19/1 1923	88′	10′	3140	10/2 1923	88′	14′	4396
— 1924	84′	3′	942	21/1 —	92′	10′	3140	— 1925	84′	4′	1256
— —	101′	8′	2512	— 1925	71′	9′ 6″	2983	13/2 1922	90′	16′	5024
— —	83′	10′	3140			8′	2512	15/2 —	91′	14′	4396
— —	77′	7′	2198	22/1 1922	95′	8′	2512	— 1923	90′	8′	2512
28/12 1923	86′	12′	3768	— 1924	85′	14′	4396	— —	85′	12′	3768
— —	87′	7′	2198	— —	83′	11′	3454	17/2 1924	79′	12′	3768
— 1924	82′	3′	942	— —	80′	7′	2198	18/2 1923	86′	11′	3454
29/12 —	76′	2′ 6″	785	23/1 1922	90′	8′	2512	21/2 —	89′	15′	4710
30/12 1923	82′	10′	3140	— —	83′	15′	4710	— 1924	86′	17′	5338
— —	86′	5′ 6″	1727	— —	90′	7′	2198	22/2 1922	88′	10′	3140
— —	85′	12′	3768	24/1 1925	87′	7′ 6″	2355	— 1923	90′	14′	4396
— —	89′	9′	2826	25/1 1923	86′	8′	2512	23/2 —	93′	19′	5966
— 1924	75′	3′	942	— 1924	81′	10′ 6″	3297	25/2 —	84′	18′	5652
— —	93′	10′	3140	— 1923	91′	4′	1256	26/2 1925	87′	8′ 6″	2669
31/12 1923	80′	6′ 6″	2041	— 1924	72′	2′ 6″	785	27/2 1922	86′	15′	4710
2/1 1924	87′	7′	2198	26/1 1923	73′	6′	1884	— 1923	85′	4′	1256
3/1 —	80′	7′	2198	— 1921	95′	8′	2512	— —	90′	18′	5652
— —	82′	12′	3768	27/1 1922	88′	10′	3140	1/3 1922	90′	18′	5652
— —	86′	8′	2512	— —	90′	8′	2512	— —	93′	14′	4396
— —	92′	9′	2826	— —	86′	12′	3768	2/3 —	93′	17′	5338
4/1 1922	95′	4′	1256	— 1923	91′	12′	3768	3/3 1925	88′	18′	5652
— —	86′	8′	2512	— 1924	70′	8′ 6″	2669	6/3 1922	86′	17′	5338

Date	Length			Date	Length			Date	Length		
	Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.
6/3 1922	85′	7′	2198	18/3 1923	88′	22′	6908	27/3 1922	92′	18′	5652
7/3 1923	89′	8′	2512	18/3 —	83′	18′	5652	1/4 —	93′	12′	3768
8/3 —	92′	19′	5966	19/3 —	84′	8′	2512	— —	73′	12′	3768
12/3 1921	82′	17′	5338	— 1925	90′	19′	5966	4/4 1921	85′	10′	3140
— 1925	88′	18′	5652	22/3 —	82′	13′	4082	6/4 1925	81′	18′	5652
13/3 1922	74′	17′	5338	23/3 1922	86′	18′	5652	8/4 1922	82′	17′	5338
14/3 —	85′	16′	5024	— —	97′	15′	4710	10/4 —	87′	23′	7222
— 1923	90′	14′	4396	24/3 —	82′	20′	6280	— —	74′	15′	4710
15/3 —	91′	20′	6280	25/3 —	88′	17′	5338	4/5 1923	85′	23′	7222
16/3 1922	88′	14′	4396	— —	85′	16′	5024	7/5 1925	92′	5′	1570
17/3 1923	81′	14′	4396	26/3 1921	85′	17′	5338	21/5 1923	88′	24′	7536

a marked dispersion. I, therefore, consulted the director of the Statistical Office of the Norwegian Life Insurance Companies, Herr Fr. Lange-Nielsen, and at his suggestion decided to apply the divergence measurement which has the largest and best supported application, viz. the standard deviation, "Mean Error". Herr Lange-Nielsen has thus estimated the standard deviation of the measurements from the average for every month during the whaling season.

Regarding the definition and calculation of the standard of deviation Herr Lange-Nielsen writes as follows:

"In the month concerned the deviation from the average is calculated for each measurement. All these deviations are raised to the square and all the figures thereby obtained are added together, after which the total is divided by the number of measurements. If we extract the square root of this quotient we have the standard of deviation."

I now give the tables and curves which result from Lange-Nielsen's calculations.

He gives the following explanation of these "the standard deviation is designated in the tables by σ. As it is natural that the standard deviation should be greater when the average length is large than when it is small, I have further calculated the so-called coefficient of variation which gives the standard deviation as the percentage of the average length concerned. The coefficient of variation thus gives a measure of the relative dispersion of the measurements from the average. This is shewn on the general table by the letter v. For the further elucidation of the deviation there are given the largest and smallest foetus length measured during the month concerned and the number percent of the total measurements collected during the month which fall between $L—\sigma$ and $L + \sigma$, for which margin graphic representations are also given."

"As will be seen the measurements diverge greatly. Coefficients of variation of 40—50 % of the average length concerned frequently occur in this material. For purposes of comparison it may be mentioned that I have calculated the average length (L) the standard deviation (σ) and the coefficient of variation (V) for the 107 mother fin whales caught in March (see later in tables for fin whales) and found that (L) = 22.08 m., (σ) = 0.172 m., and (V) = 7.8 %. 69 % of the measurements lie between (L) plus σ and (L) minus σ.

The corresponding 107 foetuses have a coefficient of variation of 39.40 %.

I now give a number of graphic representations to illustrate these conditions.

A. represents the average length of a blue whale foetus, the one curve giving the conditions in the material to hand, viz. the previously mentioned 593 foetuses from all the whaling fields of the Southern Seas, and the other curve giving the conditions in the previously mentioned material from the permanent shore stations of South Georgia (281 foetuses). **B.** gives a representation of the deviations of the measurements in the whole of the existing material (593 foetuses). **C.** gives the same representation of the material from the permanent shore stations of South Georgia (281 foetuses).

Figure 20. **A.** Average length of blue whale foetuses in the Southern Seas 1920—25.
———— all measurements from the Southern Seas.
- - - - - - - all measuremeuts from South Georgia.

D. gives a graphic illustration of the divergence of the measurements from the average — a curve of frequency for the measurements — which shews how the 156 blue whale foetuses measured in December are distributed. It is shewn how many of the foetuses are up to two feet in length (6), how many are over two feet and up to 4 feet (30), etc., and these figures are then placed vertically on the longitudinal scale in the middle of the relative intervals 0—2 feet, 2—4 feet, etc.

As will be noticed, the curve on the whole is regular and shews an almost symmetrical distribution, although there are slight irregularities in the case of the highest groups of sizes.

In connection with the graphic illustration "B" there is given a table of the

calculations of average size (L) standard deviation (σ) and coefficient of variation for the whole of the material of blue whale foetuses (Table 31, p. 66).

Figure 21. **B.** Blue whale foetuses in the Southern Seas 1920—25.
— · — · — average length + σ.
——— — — —
- - - - - - — — — σ.
○ maximum and minimum length.

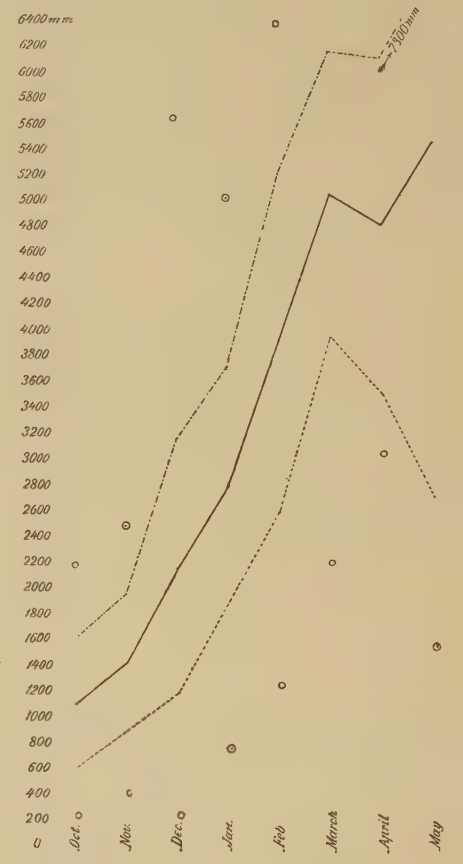

Figure 22. **C.** Blue whale foetuses measured at South Georgia 1920—25.
— · — · — Average length + σ.
——— — — —
- - - - - - — — — σ.
⊙ maximum and minimum length.

There is also in connection with the graphic illustration "C" a table shewing the corresponding calculations of blue whale foetuses measured in South Georgia (Table 32, p. 66).

Before proceeding to draw conclusions from the material regarding blue whale foetuses submitted and calculated, I will, however, also submit similar material regarding fin whale foetuses. The fact is, it appears from the tables and from the

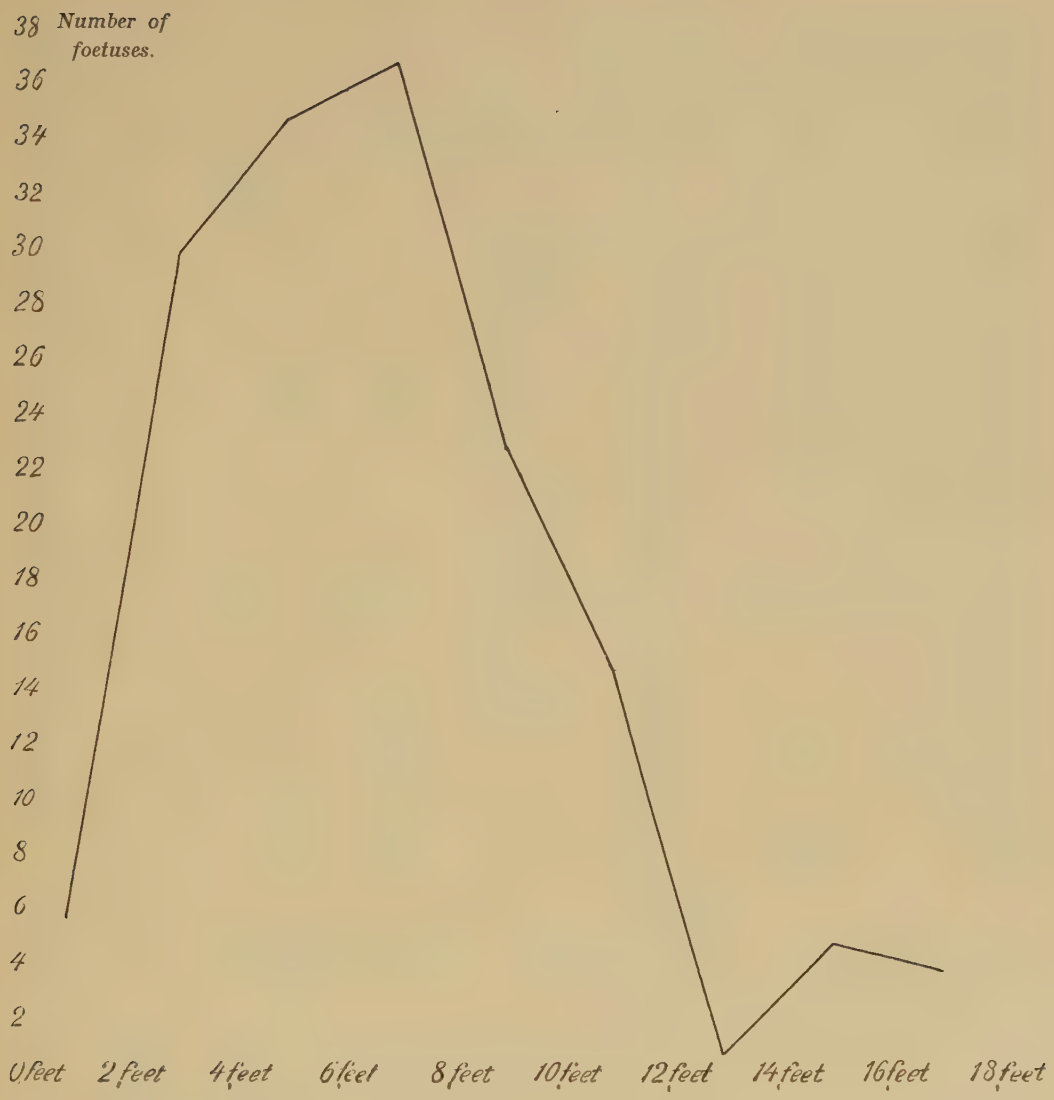

Figure 23. **D.** Blue whale foetuses. December. Frequency-curve for length of foetuses.

graphic illustrations that the breeding conditions of fin whales and blue whales are on the whole parallel. We also find here the two main features which were pointed out when discussing the blue whale:—

1) The fin whale is seen to breed in all the months of the year.
2) In spite of this it appears from the measurements that a majority of female fin whales, as is the case with the blue whale, have a more restricted period of breeding which only extends over a period of some few months.

Table 31.

Measurements of whale foetuses. Blue whale.

Total material.

Month	Number	Average length L	Standard deviation σ	Coefficient of variation V	Maximum length	Minimum length	number of measurements between $L+\sigma$ and $L-\sigma$ in %
October...	21	180 cm.	140 cm.	83.83 %	534 cm.	26 cm.	80 %
November.	74	173 -	91 -	52.60 -	502 -	42 -	81 -
December.	156	228 -	112 -	49.12 -	565 -	26 -	71 -
January ..	139	268 -	115 -	42.91 -	628 -	63 -	76 -
February .	81	343 -	144 -	41.98 -	628 -	18 -	60 -
March	70	452 -	148 -	32.74 -	848 -	157 -	71 -
April	47	422 -	155 -	36.73 -	848 -	188 -	72 -
May.....	5	540 -	221 -	40.93 -	754 -	157 -	80 -

Table 32.

Measurements of whale foetuses. Blue whale.

Measured at South Georgia.

Month	Number	Average length L	Standard deviation σ	Coefficient of variation V	Maximum length	Minimum length	Number of measurements between $L+\sigma$ and $L-\sigma$ in %
October....	17	113 cm.	50 cm.	44.25 %	220 cm.	26 cm.	76 %
November..	44	144 -	54 -	37.50 -	251 -	42 -	68 -
December..	95	217 -	97 -	44.70 -	565 -	26 -	73 -
January ...	55	281 -	91 -	32.38 -	502 -	79 -	64 -
February ..	32	391 -	130 -	33.25 -	628 -	126 -	63 -
March	28	504 -	111 -	22.02 -	691 -	220 -	79 -
April	7	480 -	130 -	27.08 -	722 -	314 -	71 -
May.....	3	544 -	274 -	50.37 -	754 -	157 -	67 -

I will first give all the measurements of foetuses in the Southern Seas made by Norwegian whalers during the period previously mentioned (see Table 33, pp. 67—70).

By studying these measurements it will also be found that there occur foetuses of the most varying kinds practically speaking throughout the entire whaling season, although the differences are not quite so marked as in the case of the blue whale foetus.

The largest foetus measured in October is thus not more than five feet, and the smallest 11 inches. In November the largest foetus is 8 feet and the smallest 4 inches.

In December the largest foetus is 13 feet and the smallest 2 feet
- January - — — - 15 — — - — $1^1/_2$ —
- February - — — - 18 — — - — 8 inches
- March - — — - 21 — — - — 3 feet
- April - — — - 21 — — - — 4 —
- May - — — - 20 — — - — 9 —

Table 33. Fin Whale Foetuses.

Measured in the Southern Seas, arranged in accordance with the time of the year when the mother animal was captured. Seasons, 1922—1923, 1923—1924, 1924—1925, and also in the case of the »Tönsberg Whaling Company« 1920—1921, 1921—1922.

Date	Length			Date	Length			Date	Length		
	Mother	Foetus			Mother	Foetus			Mother	Foetus	
	feet	feet	mm.		feet	feet	mm.		feet	feet	mm.
19/9 1920	76′	2′	628	21/11 1924	67′	5′ 4″	1674	12/12 1923	78′	7′	2198
6/10 1924	66′	1′ 4″	418	22/11 —	75′	7′	2198	— —	75′	5′	1570
5/10 1920	70′	2′	628	23/11 1923	69′	3′	942	— —	76′	6′	1884
7/10 1924	67′	1′ 2″	366	— —	70′	4′ 6″	1413	13/12 1920	63′	5′	1570
8/10 —	71′	1′ 5″	444	— —	68′	5′	1570	— —	75′	6′	1884
— —	74′	2′ 6″	785	— —	65′	3′	942	14/12 1923	89′	6′ 6″	2041
10/10 —	68′	2′ 8″	837	24/11 —	69′	3′ 6″	1099	— —	70′	3′ 6″	1099
— —	69′	4′	1256			3′ 6″	1099	— —	73′	9′	2826
18/10 1920	70′	1′ 6″	471	— —	68′	7′	2198	— —	70′	7′	2198
19/10 1923	79′	1′ 2″	366	26/11 —	70′	3′ 6″	1099	16/12 1922	77′	8′	2512
20/10 —	78′	3′	942	27/11 —	69′	3′ 6″	1099	— 1923	70′	2′ 6″	785
22/10 —	72′	1′ 6″	471	— —	64′	5′	1570	— —	76′	6′	1884
— —	76′	5′	1570	— 1924	73′	5′	1570	17/12 —	69′	6′	1884
— —	79′	4′	1256	— —	73′	7′ 3″	2276	— —	68′	4′ 6″	1413
24/10 1924	71′	11″	287			6′ 8″	2090	— 1924	80′	4′	1256
4/11 —	69′	4′ 6″	1413	28/11 1923	70′	5′ 9″	1805	18/12 1922	62′	3′	942
— —	71′	3′	942	— —	75′	5′	1570	19/12 1924	76′	5′	1570
7/11 1920	75′	3′	942	— 1924	77′	6′	1884	— —	68′	4′	1256
8/11 1924	76′	2′ 6″	785	29/11 1923	64′	3′ 6″	1099	20/12 1922	65′	6′	1884
— —	73′	3′	942	— —	63′	4′	1256	— 1923	74′	7′	2198
— —	77′	4″	104	— 1924	74′	7′ 6″	2355	21/12 1924	68′	7′	2198
9/11 —	78′	3′ 4″	1046	30/11 1923	71′	6′ 3″	1962	22/12 —	60′	3′	942
10/11 —	77′	4′	1256	— 1920	75′	5′	1570	— —	70′	4′	1256
— —	73′	6′ 2″	1936	— —	64′	7′	2198	— 1921	72′	9′	2826
— —	78′	4′ 4″	1360	— —	78′	5′	1570	23/12 1922	77′	6′	1884
12/11 —	66′	2′ 8″	837	— 1924	72′	3′	942	— 1924	77′	7′	2198
— —	76′	5′	1570	1/12 1923	65′	6′	1884	— —	74′	10′	3140
— —	76′	5′10″	1831	— —	72′	4′	1256	24/12 1923	78′	6′	1884
14/11 —	76′	8′	2512	— 1924	79′	7′ 6″	2355	— —	72′	10′	3140
— —	71′	5′	1570	3/12 1923	70′	7′	2198	— —	74′	6′	1884
16/11 1923	69′	1′ 8″	523	5/12 —	67′	7′	2198	— 1924	67′	13′	4082
17/11 —	71′	3′	942	— 1924	50′(?)	10″	261	26/12 1922	67′	5′	1570
— 1924	76′	4′ 6″	1413	6/12 1922	70′	12′	3768	— 1923	72′	4′	1256
18/11 1923	72′	5′	1570	— 1924	47′(?)	2′	628	27/12 —	65′	8′	2512
— 1924	71′	5′	1570	7/12 1923	70′	6′	1884	— —	72′	3′	942
19/11 1923	69′	1′ 8″	523	8/12 1920	78′	2½′	785	— 1924	73′	4′	1256
— —	69′	5′	1570	10/12 —	76′	6′	1884	— —	71′	2′	628
— 1924	74′	5′	1570	11/12 —	67′	6′	1884	28/12 1923	79′	8′	2512
— —	78′	3′	942	10/12 —	75′	3′	942	— 1924	75′	9′	2826

Date	Length			Date	Length			Date	Length		
	Mother feet	Foetus feet	mm.		Mother feet	Foetus feet	mm.		Mother feet	Foetus feet	mm.
28/12 1924	75′	8′	2512	19/1 1925	78′	7′	2198	30/1 1925	76′	15′	4710
29/12 —	63′	3′	942			8′	2512	— —	79′	11′	3454
30/12 1922	66′	8′	2512	20/1 1923	68′	7′	2198	31/1 1924	72′	5′	1570
— —	72′	6′	1884	— 1925	66′	9′	2826	— —	70′	7′	2198
3/1 1923	75′	10′	3140	21/1 1923	72′	10′	3140	— —	66′	9′	2826
— —	67′	3′	942	— 1924	70′	5′	1570	— —	60′	5′	1570
— 1924	70′	9′	2826	— 1925	71′	10′	3140	— 1925	75′	12′	3768
4/1 1925	74′	4′ 6″	1413	23/1 1923	75′	14′	4396	1/2 1923	70′	3′	942
5/1 1923	70′	9′	2826	— —	72′	6′ 6″	2041	— 1925	70′	7′	2198
— 1924	70′	5′	1570	— —	62′	6′	1884	2/2 1924	63′	8′ 6″	2669
6/1 1923	70′	7′	2198	— —	73′	7′	2198	— 1923	58′	4′	1256
8/1 1924	69′	6′	1884	— —	72′	4′	1256	— —	74′	8′	2512
— 1925	72′	4′	1256	— 1925	65′	4′	1256	— 1925	72′	7′	2198
9/1 1924	75′	6′	1884	24/1 1923	61′	5′	1570	— —	77′	10′	3140
— 1925	72′	6′	1884	— 1921	80′	11′	3454	3/2 1923	75′	5′	1570
— —	64′	6′	1884	— —	66′	7′	2198	— 1921	75′	6′	1884
10/1 1923	70′	8′	2512	— 1925	70′	6′	1884	— 1924	70′	7′	2198
— 1924	69′	4′	1256	— —	77′	10′	3140	— 1925	80′	15′	4710
— —	76′	14′	4396	25/1 1924	71′	9′	2826	4/2 1923	65′	6′	1884
— 1925	70′	4′	1256	26/1 —	70′	8′	2512	— —	76′	8′	2512
11/1 —	66′	3′	942	— —	70′	10′	3140	5/2 —	77′	5′	1570
— 1921	72′	10′	3140	— —	70′	7′	2198	— —	70′	5′	1570
12/1 1923	76′	7′	2198	— 1925	75′	9′	2826	— 1924	64′	6′ 6″	2041
— 1925	70′	4′ 6″	1413	27/1 1923	70′	6′	1884	— —	70′	5′	1570
13/1 1921	73′	3′	942	— —	64′	6′	1884	— 1925	64′	6′	1884
15/1 1924	68′	9′	2826	— —	56′	3′	942	6/2 1923	77′	9′	2826
— 1921	82′	5′	1570	— —	67′	4′	1256	— —	76′	15′	4710
— 1923	75′	5′	1570	— 1924	70′	7′	2198	7/2 —	64′	7′	2198
— —	75′	1 1/2′	471	28/1 1923	64′	6′	1884	8/2 —	68′	6′	1884
16/1 —	58′	3′	942	— —	72′	4′	1256	— —	64′	7′	2198
— 1924	69′	9′	2826	— 1924	66′	7′	2198	— 1924	75′	12′	3768
— —	68′	9′	2826	— —	70′	4′	1256	9/2 1923	76′	9′	2826
— —	74′	8′	2512	— —	53′	7′	2198	— 1924	70′	8′	2512
— —	74′	10′	3140	— —	70′	7′	2198	— 1925	70′	12′	3768
— —	72′	10′	3140	— —	66′	6′ 6″	2041	10/2 —	76′	12′	3768
— 1925	70′	2′	628	— 1925	75′	11′	3454	— —	78′	17′	5338
— —	78′	15′	4710	29/1 1923	68′	7′	2198	11/2 1923	75′	14′	4396
— —	64′	7′	2198	— —	79′	12′	3768	— 1925	72′	10′ 6″	3297
17/1 1923	62′	4′	1256	— 1924	72′	5′	1570	12/2 1923	67′	18′	5652
— 1925	71′	12′	3768	— —	68′	6′	1884	— 1921	68′	5′	1570
— —	69′	7′	2198	— —	70′	10′	3140	— 1925	62′	6′	1884
19/1 —	72′	10′	3140	30/1 1925	68′	4′	1256	— —	70′	6′	1884
— —	73′	12′	3768	— —	63′	6′	1884	13/2 1924	56′	7′	2198

Date	Length			Date	Length			Date	Length		
	Mother	Foetus			Mother	Foetus			Mother	Foetus	
	feet	feet	mm.		feet	feet	mm.		feet	feet	mm.
15/2 1925	73′	17′	5338	27/2 1924	74′	10′	3140	10/3 1925	64′	4′	1256
— 1921	80′	10′	3140	— 1925	74′	18′	5652	11/3 1923	63′	14′	4396
16/2 1923	70′	5′	1570	— —	75′	7′ 8″	2407	— —	70′	7′	2198
— —	73′	10′	3140	28/2 1924	68′	8′	2512	— 1924	69′	11′	3454
— —	64′	6′	1884	— 1925	70′	10′	3140	— 1925	73′	10′	3140
— —	70′	7′	2198	1/3 1924	77′	13′	4082	— —	69′	5′	1570
— —	70′	8′	2512	— —	72′	6′	1884	— —	70′	9′	2826
— —	62′	8′	2512	— —	70′	8′	2512	— —	70′	3′	942
— 1925	71′	11′	3454	— 1925	73′	12	3768	12/3 1923	74′	8′	2512
17/2 1921	72′	8′	2512	— —	70′	8′	2512	— —	70′	12′	3768
— —	78′	10′	3140	2/3 1924	70′	10′	3140	— —	73′	8′	2512
— 1923	70′	4′	1256	— 1922	80′	12′	3768	— 1925	58′	9′	2826
— 1924	72′	14′ 6″	4553	3/3 1923	65′	16′	5024	— —	76′	19′	5966
— 1925	70′	3′ 6″	1099	— 1924	69′	7′	2198	13/3 1923	69′	4′	1256
— —	46′(?)	3′	942	4/3 —	70′	6′	1884	— —	71′	4′	1256
18/2 1921	77′	5′	1570	— 1925	80′	7′	2198	— —	74′	12′	3768
— 1923	70′	4′	1256	— —	83′	15′	4710	— —	70′	6′	1884
19/2 —	70′	15′	4710	5/3 1921	75′	6′	1884	— —	70′	16′	5024
— 1924	75′	13′	4082	— 1923	56′	8′	2512	— —	70′	5′	1570
— 1925	66′	15′	4710	— 1925	82′	10′	3140	— 1924	72′	14′	4396
— —	75′	16′	5024	— —	60′	5′	1570	14/3 1923	63′	10′	3140
20/2 1923	70′	12′	3768	— —	73′	8′	2512	— —	74′	6′	1884
— 1925	67′	5′	1570	6/3 1923	69′	15′	4710	— 1921	79′	17′	5338
21/2 1921	78′	14′	4396	— —	75′	15′	4710	15/3 1923	70′	6′	1884
— 1923	78′	9′	2826	7/3 —	70′	12′	3768	— —	70′	7′	2198
— —	62′	0′ 8″	209	— —	70′	7′	2198	— 1925	70′	8′	2512
— 1924	74′	5′ 6″	1727	— 1925	60′	4′	1256	16/3 1923	74′	15′	4710
22/2 1921	73′	17′	5338	— —	70′	10′	3140	— 1925	75′	6′	1884
— 1923	74′	7′	2198	8/3 1923	62′	8′	2512	— —	68′	4′	1256
— —	70′	6′	1884	— —	70′	6′	1884	17/3 1924	78′	10′	3140
— 1925	78′	15′	4710	— 1925	73′	6′	1884	— 1925	70′	16′	5024
23/2 1923	67′	7′	2198	— —	74′	8′	2512	— —	82′	11′	3454
— 1924	66′	5′	1570	— —	64′	12′	3768	— —	70′	16′	5024
— 1925	66′	17′	5338	9/3 1923	64′	10′	3140	18/3 1923	70′	4′	1256
— —	73′	15′	4710	— 1925	70′	6′	1884	— 1925	70′	8′	2512
24/2 1923	60′	0′11″	287	10/3 1923	70′	10′	3140	19/3 1923	62′	7′	2198
— 1924	74′	11′	3454	— —	78′	11′	3454	20/3 —	68′	18′	5652
25/2 1923	70′	18′	5652	— —	71′	6′	1884	— —	70′	8′	2512
26/2 —	62′	12′	3768	— 1924	72′	8′	2512	— —	64′	13′	4082
— —	70′	7′	2198	— 1925	70′	6′	1884	— —	66′	6′	1884
— 1924	70′	12′	3768	— —	83′	10′	3140	21/3 1925	70′	12′	3768
— —	68′	7′	2198	— —	64′	7′	2198	22/3 1923	63′	6′	1884
— 1925	65′	9′	2826	— —	70′	7′	2198	— —	71′	6′	1884

Date	Length			Date	Length			Date	Length		
	Mother	Foetus			Mother	Foetus			Mother	Foetus	
	feet	feet	mm.		feet	feet	mm.		feet	feet	mm.
23/3 1923	66′	10′	3140	2/4 1923	68′	6′	1884	14/4 1921	77′	18′	5652
— 1925	73′	16′	5024	— —	66′	6′	1884	— 1923	70′	8′	2512
— —	60′	10′	3140	3/4 —	68′	4′	1256	— 1925	68′	10′	3140
24/3 1923	70′	8′	2512	— —	70′	11′	3454	15/4 —	66′	12′ 6″	3925
25/3 —	78′	12′	3768	4/4 —	58′	6′	1884	— —	65′	10′	3140
— —	68′	11′	3454	— 1924	67′	7′	2198	20/4 1923	72′	15′	4710
— 1925	75′	9′	2826	— 1925	73′	9′	2826	— 1921	78′	10′	3140
— —	72′	14′	4396	— —	75′	9′	2826	— 1924	64′	9′	2826
— —	69′	8′	2512	— —	70′	10′	3140	— 1925	80′	20′	6280
— —	80′	15′	4710	5/4 1921	75′	10′	3140	— —	69′	19′	5966
26/3 1923	66′	21′	6594	6/4 1925	68′	7′	2198	21/4 1923	70′	10′	3140
— —	69′	15′	4710	7/4 1923	72′	15′	4710	— —	69′	20′	6280
— —	74′	12′	3768	— 1925	79′	6′	1884	— —	69′	9′	2826
— 1924	68′	6′	1884	— —	72′	12′	3768	— —	80′	14′	4396
27/3 1923	66′	10′	3140	8/4 1924	71′	9′	2826	— 1921	73′	17′	5338
— —	58′	12′	3768	9/4 1923	71′	16′	5024	— —	77′	21′	6594
— 1924	79′	12′	3768	— 1921	75′	15′	4710	22/4 —	69′	10′	3140
— 1925	69′	7′	2198	— 1923	67′	16′	5024	— 1925	82′	10′	3140
— —	73′	7′	2198	— —	70′	5′	1570	24/4 1922	73′	12′	3768
28/3 1923	73′	12′	3768	— —	55′	8′	2512	25/4 —	67′	14′	4396
— 1925	64′	9′	2826	10/4 —	69′	14′	4396	1/5 1925	78′	11′	3454
29/3 1924	73′	15′	4710	— —	61′	4′	1256	3/5 —	75′	20′	6280
30/3 1925	76′	13′	4082	— 1925	77′	8′	2512	8/5 —	80′	17′	5338
— —	69′	4′	1256	11/4 1923	56′	10′	3140	9/5 1921	78′	10′	3140
31/3 1923	72′	10′	3140	— 1925	72′	14′	4396	11/5 —	79′	18′	5652
— —	58′	7′	2198	12/4 1924	73′	18′	5652	— 1922	74′	20′	6280
1/4 —	70′	9′	2826	— —	67′	8′	2512	23/5 1921	80′	9′	2826
— —	68′	9′	2826	13/4 1925	70′	10′	3140	— —	75′	18′	5652
2/4 —	68′	10′	3140	14/4 1924	75′	18′	5652	24/5 —	76′	17′	5338

The fin whale has thus also no definitely short limited periods of breeding, but in this case, too, breeding is seen to take place practically throughout the year.

Furthermore, it will also be observed in this case that the number of quite small foetuses is far more numerous at the beginning of the season than towards the end, when quite small foetuses are no longer found in the whole of the large amount of material. On the other hand the number of small foetuses increases greatly as by degrees the season advances.

In this case, too, I have divided the large amount of material into year series in order thereby to obtain a picture of each individual whaling season, because it must be of the greatest interest to be able to shew that the curve obtained as

an illustration of the growth of the foetus during the season repeats itself in its main features year after year.

The whaling seasons 1920—1921 and 1921—1922 are in this case also combined into one season, as the measurements for each of those seasons were far too scanty to give a definite picture of the conditions. I also give in this case four different series of measurements:

First Series:	measurements for	1920—1921 and 1921—1922.....	42 foetuses
Second —	—	- 1922—1923.....	130 —
Third —	—	- 1923—1924.....	124 —
Fourth —	—	- 1924—1925.....	166 —

In similarity with what was said in discussing the blue whale foetus I have also taken in this case calculations of the average size of the foetus for each month during the whaling season.

The result of these calculations is as follows:

Calculation of the average size of the fin whales foetuses measured in the Southern Seas.

Calculation for the seasons 1920—1921 and 1921—1922:

In September	1	foetus,	average	length	2	feet			=	628 mm.
- October.....	2	foetuses	—	—	1	foot	9	inches	=	550 —
- November.....	3	—	—	—	4	feet	4	—	=	1361 —
- December.....	4	—	—	—	4	—	$10^{5}/_{10}$	—	=	1530 —
- January	6	—	—	—	5	—	11	—	=	1858 —
- February	8	—	—	—	9	—	$4^{5}/_{10}$	—	=	2944 —
- March	3	—	—	—	11	—	8	—	=	3664 —
- April	9	—	—	—	14	—	$1^{3}/_{10}$	—	=	4431 —
- May.....	6	—	—	—	15	—	4	—	=	4815 —

Calculation for the season 1922—1923:

In December.....	8	foetuses,	average	length	6	feet	9	inches	=	2120 mm.
- January	20	—	—	—	6	—	$10^{8}/_{10}$	—	=	2167 —
- February	32	—	—	—	7	—	$10^{8}/_{10}$	—	=	2480 —
- March	48	—	—	—	9	—	$10^{8}/_{10}$	—	=	3108 —
- April	22	—	—	—	10	—	3	—	=	3218 —

Calculation for the season 1923—1924:

In October.....	5	foetuses,	average	length	2	feet	$11^{2}/_{10}$	inches	=	921 mm.
- November.....	21	—	—	—	4	—	3	—	=	1334 —
- December.....	26	—	—	—	6	—	0	—	=	1884 —
- January	34	—	—	—	7	—	$3^{2}/_{10}$	—	=	2281 —
- February	19	—	—	—	8	—	7	—	=	2695 —
- March	13	—	—	—	9	—	$8^{3}/_{10}$	—	=	3043 —
- April	6	—	—	—	11	—	6	—	=	3611 —

Calculation for the season 1924—1925:

In October.....	7	foetuses, average length		2	feet	0	inches	=	628 mm.
- November.....	26	—	—	—	4	— $8^{7}/_{10}$	—	=	1485 —
- December.....	18	—	—	—	5	— $6^{2}/_{10}$	—	=	1733 —
- January	29	—	—	—	7	— $8^{2}/_{10}$	—	=	2414 —
- February	25	—	—	—	10	— 10	—	=	3401 —
- March	43	—	—	—	9	— $1^{7}/_{10}$	—	=	2870 —
- April	15	—	—	—	11	— $1^{2}/_{10}$	—	=	3485 —
- May.....	3	—	—	—	16	— 0	—	=	5024 —

The average figures found here are shewn on the following curves.

Figure 24. Average size of fin whale foetuses in the Southern Seas.

Figure 25. Average size of fin whale foetuses in the Southern Seas.

It thus appears from these curves:

1) The curve ascends, and the ascent is even more regular than that of the blue whale foetus.
2) The curve practically speaking is the same for each year.

I have also in the case of the fin whale foetuses combined the whole of the material and estimated it as a whole in order thereby to obtain one picture.

We then obtain the following average figures for each month:

In September	1	foetus,	average	length	2	feet	0	inches	=	628 mm.
- October.....	14	foetuses	—	—	2	—	$3^{4}/_{10}$	—	=	720 —
- November.....	50	—	—	—	4	—	$6^{1}/_{16}$	—	=	1414 —
- December.....	56	—	—	—	5	—	$10^{7}/_{10}$	—	=	1850 —
- January	89	—	—	—	7	—	$2^{8}/_{10}$	—	=	2271 —
- February	84	—	—	—	9	—	$^{8}/_{10}$	—	=	2846 —
- March	107	—	—	—	9	—	$7^{4}/_{10}$	—	=	3020 —
- April	52	—	—	—	11	—	$3^{6}/_{10}$	—	=	3549 —
- May.....	9	—	—	—	15	—	$6^{7}/_{10}$	—	=	4885 —

Total... 462 fin whale foetuses.

In order to deal with the material for the fin whale foetus quite parallel with that for the blue whale foetus, I have also in this case separated all the measurements derived from the permanent whaling stations in South Georgia, since there is reason to believe that these measurements were more carefully carried out, and first and foremost because it may be assumed that in this instance even small foetuses in all cases were found and have been included in the statistics.

The series given on pp. 74—75 is derived from measurements made at the Tönsberg Hvalfangeri Station during the seasons 1921—1922, 1922—1923, 1923—1924 and 1924—1925, and also at the Vestfold Station during the season 1924—1925.

The calculated averages are as follows:

Table 34. Average Length.

In September	1	foetus,	average	length	2	feet			=	628 mm.
- October.....	14	foetuses	—	—	2	—	$3^{3}/_{5}$	inches	=	721 —
- November.....	48	—	—	—	4	—	$7^{1}/_{4}$	—	=	1445 —
- December.....	44	—	—	—	5	—	$9^{2}/_{5}$	—	=	1825 —
- January	36	—	—	—	7	—	$10^{1}/_{2}$	—	=	2472 —
- February	24	—	—	—	8	—	$11^{3}/_{5}$	—	=	2815 —
- March	14	—	—	—	13	—	$0^{6}/_{7}$	—	=	4105 —
- April	18	—	—	—	15	—	3	—	=	4788 —
- May.....	11	—	—	—	14	—	9	—	=	4624 —

Total... 210 fin whale foetuses.

Table 35. Fin Whale Foetuses.

Measured at South Georgia: by the Tönsberg Whaling Company 1921—22—23—24—25 and by Vestfold 1924—25.

Date	Length			Date	Length			Date	Length		
	Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.
19/9 1920	76′	2′	628	23/11 1923	69′	3′	942	14/12 1923	70′	3′ 6″	1099
5/10 —	70′	2′	628	— —	70′	4′ 6″	1413	— —	73′	9′	2826
6/10 1924	66′	1′ 4″	418	— —	68′	5′	1570	— —	70′	7′	2198
7/10 —	67′	1′ 2″	366	24/11 —	69′	3′ 6″	1099	16/12 —	70′	2′ 6″	785
8/10 —	71′	1′ 5″	444			3′ 6″	1099	— —	76′	6′	1884
— —	74′	2′ 6″	785	— —	68′	7′	2198	17/12 —	69′	6′	1884
10/10 —	68′	2′ 8″	837	26/11 —	70′	3′ 6″	1099	— —	68′	4′ 6″	1413
— —	69′	4′	1256	27/11 —	69′	3′ 6″	1099	— 1924	80′	4′	1256
18/10 —	70′	1′ 6″	471	— —	64′	5′	1570	19/12 —	76′	5′	1570
19/10 1923	79′	1′ 2″	366	— 1924	73′	5′	1570	— —	68′	4′	1256
20/10 —	78′	3′	942	— —	73′	7′ 3″	2276	20/12 1923	74′	7′	2198
22/10 —	72′	1′ 6″	471			6′ 8″	2090	21/12 1924	68′	7′	2198
— —	76′	5′	1570	28/11 1923	70′	5′ 9″	1805	22/12 1921	72′	9′	2826
— —	79′	4′	1256	— —	75′	5′	1570	23/12 1922	77′	6′	1884
24/10 1924	71′	0′11″	287	— 1924	77′	6′	1884	— 1924	77′	7′	2198
2/11 1920	75′	3′	942	29/11 1923	64′	3′ 6″	1099	— —	74′	10′	3140
4/11 1924	71′	3′	942	— —	63′	4′	1256	24/12 1923	78′	6′	1884
— —	69′	4′ 6″	1413	— 1924	74′	7′ 6″	2355	— —	72′	10′	3140
8/11 —	76′	2′ 6″	785	30/11 1923	71′	6′ 3″	1962	— —	74′	6′	1884
— —	77′	0′ 4″	104	— —	64′	7′	2198	27/12 —	65′	8′	2512
— —	73′	3′	942	— 1924	72′	3′	942	— —	72′	3′	942
9/11 —	78′	3′ 4″	1046	— 1920	75′	5′	1570	— 1924	71′	2′	628
10/11 —	77′	4′	1256	— —	78′	5′	1570	— —	73′	4′	1256
— —	73′	6′ 2″	1936	1/12 1923	65′	6′	1884	28/12 1923	79′	8′	2512
— —	78′	4′ 4″	1360	— —	72′	4′	1256	— 1924	75′	9′	2826
12/11 —	66′	2′ 8″	837	— 1924	79′	7′ 6″	2355	— —	75′	8′	2512
— —	76′	5′10″	1831	3/12 1923	70′	7′	2198	4/1 1925	74′	4′ 6″	1413
14/11 —	76′	8′	2512	5/12 —	67′	7′	2198	8/1 1924	69′	6′	1884
— —	71′	5′	1570	— 1924	50′(?)	0′10″	261	9/1 —	75′	6′	1884
16/11 1923	69′	1′ 8″	523	6/12 —	47′(?)	2′	628	— 1925	64′	6′	1884
17/11 —	71′	3′	942	7/12 1923	70′	6′	1884	10/1 1924	69′	4′	1256
— 1924	76′	4′ 6″	1413	8/12 1920	78′	2′ 6″	785	11/1 1921	72′	10′	3140
18/11 1923	72′	5′	1570	10/12 —	75′	3′	942	13/1 —	73′	3′	942
— 1924	71′	5′	1570	— 1923	76′	6′	1884	15/1 —	82′	5′	1570
19/11 1923	69′	1′ 8″	523	12/12 —	78′	7′	2198	— 1923	75′	5′	1570
— —	69′	5′	1570	— —	76′	6′	1884	— —	75′	1′ 6″	471
— 1924	78′	3′	942	— —	75′	5′	1570	— 1924	68′	9′	2826
— —	74′	5′	1570	13/12 1920	63′	5′	1570	16/1 —	69′	9′	2826
21/11 —	67′	5′ 4″	1674	— —	75′	6′	1884	— —	68′	9′	2826
22/11 —	75′	7′	2198	14/12 1923	89′	6′ 6″	2041	— —	74′	8′	2512

Date	Length			Date	Length			Date	Length		
	Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.		Mother feet	Foetus feet	Foetus mm.
$^{16}/_{1}$ 1924	74′	10′	3140	$^{10}/_{2}$ 1925	76′	12′	3768	$^{5}/_{4}$ 1921	75′	10′	3140
— —	72′	10′	3140	— —	78′	17′	5338	$^{9}/_{4}$ —	75′	15′	4710
— 1925	64′	7′	2198	$^{11}/_{2}$ —	72′	10′ 6″	3297	$^{9}/_{4}$ 1923(?)	78′	22′	6908
$^{17}/_{1}$ —	71′	12′	3768	$^{12}/_{2}$ 1921	68′	5′	1570	$^{10}/_{4}$ —	69′	14′	4396
$^{19}/_{1}$ —	78′	7′	2198	$^{15}/_{2}$ —	80′	10′	3140	$^{11}/_{4}$ 1925	72′	14′	4396
		8′	2512	$^{16}/_{2}$ 1925	71′	11′	3454	$^{12}/_{4}$ 1924	73′	18′	5652
$^{21}/_{1}$ 1923	72′	10′	3140	$^{17}/_{2}$ 1921	72′	8′	2512	$^{14}/_{4}$ 1921	77′	18′	5652
— 1924	70′	5′	1570	— —	78′	10′	3140	— 1924	75′	18′	5652
— 1925	71′	10′	3140	— 1924	72′	14′ 6″	4553	$^{15}/_{4}$ 1925	66′	12′ 6″	3925
$^{23}/_{1}$ 1923	72′	6′ 6″	2041	— 1925	70′	3′ 6″	1099	— —	65′	10′	3140
— —	62′	6′	1884	— —	46′(?)	3′	942	$^{20}/_{4}$ —	69′	19′	5966
— —	73′	7′	2198	$^{18}/_{2}$ 1921	77′	5′	1570	— —	80′	20′	6280
$^{24}/_{1}$ 1921	80′	11′	3454	$^{21}/_{2}$ 1924	74′	5′ 6″	1727	— 1921	78′	10′	3140
$^{26}/_{1}$ 1924	70′	8′	2512	— 1921	78′	14′	4396	$^{21}/_{4}$ —	73′	17′	5338
— —	70′	10′	3140	$^{22}/_{2}$ —	73′	17′	5338	— —	77′	21′	6594
— 1925	75′	9′	2826	$^{27}/_{2}$ 1925	75′	7′ 8″	2407	$^{22}/_{4}$ —	69′	10′	3140
$^{28}/_{1}$ 1924	66′	7′	2198	$^{1}/_{3}$ 1924	77′	13′	4082	$^{24}/_{4}$ 1922	73′	12′	3768
— —	70′	4′	1256	$^{2}/_{3}$ 1922	80′	12′	3768	$^{25}/_{4}$ —	67′	14′	4396
$^{29}/_{1}$ 1923	79′	12′	3768	$^{4}/_{3}$ 1925	83′	15′	4710	$^{1}/_{5}$ 1925	78′	11′	3454
$^{30}/_{1}$ 1925	76′	15′	4710	$^{5}/_{3}$ 1921	75′	6′	1884	$^{3}/_{5}$ —	75′	20′	6280
— —	79′	11′	3454	$^{6}/_{3}$ 1923	75′	15′	4710	$^{8}/_{5}$ —	80′	17′	5338
$^{31}/_{1}$ —	75′	12′	3768	$^{10}/_{3}$ 1924	72′	8′	2512	$^{9}/_{5}$ 1921	78′	10′	3140
$^{2}/_{2}$ —	63′	8′ 6″	2669	$^{11}/_{3}$ —	69′	11′	3454	$^{11}/_{5}$ —	79′	18′	5652
— —	72′	7′	2198	$^{12}/_{3}$ 1925	76′	19′	5966	— 1922	74′	20′	6280
— —	77′	10′	3140	$^{13}/_{3}$ 1924	72′	14′	4396	$^{14}/_{5}$ 1923(?)	70′	8′	2512
$^{3}/_{2}$ 1923	75′	5′	1570	$^{14}/_{3}$ 1921	79′	17′	5338	$^{21}/_{5}$ — (?)	80′	14′	4396
— 1925	80′	15′	4710	$^{17}/_{3}$ 1924	78′	10′	3140	$^{23}/_{5}$ 1921	80′	9′	2826
— 1921	75′	6′	1884	— 1925	70′	16′	5024	— —	75′	18′	5652
$^{5}/_{2}$ 1923	77′	5′	1570	$^{21}/_{3}$ —	70′	12′	3768	$^{24}/_{5}$ —	76′	17′	5338
— —	70′	5′	1570	$^{25}/_{3}$ —	80′	15′	4710				

This material regarding the fin whale foetus was then further treated by Herr Fr. Lange-Nielsen in just the same manner as previously described in dealing with the blue whale foetus, and the following graphic illustrations and tables 36 & 37 shew the results he has obtained.

As is known, it has hitherto not been possible to determine with exactitude the duration of gestation amongst the large baleen whales. It is also quite natural that an entirely exact determination of the length of this period cannot possibly be obtained, since these animals, whose migrations and place of resort during a great part of the year are still not known with certainty, to a very large extent evade all observation and control.

Table 36.

Measurements of whale foetuses. Fin whale.

Total material.

Month	Number	Average length L	Standard deviation σ	Coefficient of variation V	Maximum length	Minimum length	Number of measurements between $L+\sigma$ and $L-\sigma$ in %
Oktober ..	14	72 cm.	39 cm.	53.68 %	157 cm.	29 cm.	71 %
November.	50	141 -	51 -	36.17 -	251 -	10 -	72 -
December .	56	184 -	77 -	41.85 -	408 -	26 -	70 -
January ..	89	227 -	93 -	40.97 -	471 -	47 -	69 -
February .	84	285 -	134 -	47.02 -	565 -	21 -	70 -
March	107	302 -	119 -	39.40 -	659 -	94 -	73 -
April	52	355 -	137 -	38.59 -	659 -	126 -	67 -
May.....	9	488 -	128 -	26.23 -	628 -	283 -	44 -

Table 37.

Measurements of whale foetuses. Fin whale.

Measured at South Georgia.

Month	Number	Average length L	Standard deviation σ	Coefficient of variation V	Maximum length	Minimum length	Number of measurements between $L+\sigma$ and $L-\sigma$ in %
October....	14	72 cm.	39 cm.	53.68 %	157 cm.	29 cm.	71 %
November..	48	145 -	48 -	33.36 -	251 -	52 -	58 -
December..	44	183 -	68 -	37.46 -	314 -	26 -	64 -
January ...	36	247 -	91 -	36.84 -	471 -	47 -	69 -
February ..	24	282 -	130 -	46.22 -	534 -	94 -	71 -
March	14	410 -	107 -	26.10 -	597 -	188 -	71 -
April	18	479 -	123 -	25.58 -	691 -	314 -	61 -
May.....	11	462 -	135 -	29.11 -	628 -	251 -	55 -

The statements which were forthcoming until a few years ago were thus only to be regarded as more or less well founded guesses. The observations of those days were far too few in number and the material at the disposal of the scientist was too scanty and dispersed for him to build thereon any well founded conclusions. The results arrived at were also very varied, since some considered that the period of gestation could be estimated at 9—10 months, whilst others considered that it was probable that it could be as much as 18 months or more.

In recent years there has been a change in this state of affairs. More and more observations and measurements are forthcoming, and it now appears that there is unanimity as regards the period of gestation amongst our large species of whales, viz. that it cannot be much more or less than 1 year.

Martin A. C. Hinton, British Museum, has thus on the basis of a consider-

able amount of material and with the co-operation of Major Barrett-Hamilton's measurements and observations during a stay at South Georgia in the season 1913—1914 estimated the period of gestation amongst fin whales as a little more than 11 months.

In his book entitled "Report on Papers left by the late Major G. E. H. Barrett-Hamilton relating to the Whales of South Georgia" this author made an extremely interesting attempt to determine the "day of mating" on the basis of investigations on the length of the foetus by investigations.

He supports his calculations by a number of measurements of the fin whale foetus.

Mr. Hinton writes:

"As stated when discussing the humpback foetuses, I no longer think that the foetus grows at an equal rate throughout the period of gestation. I have before me data relating to a large number of finner foetuses, and I have endeavoured to find a new and more satisfactory basis upon which to calculate the possible pairing dates.

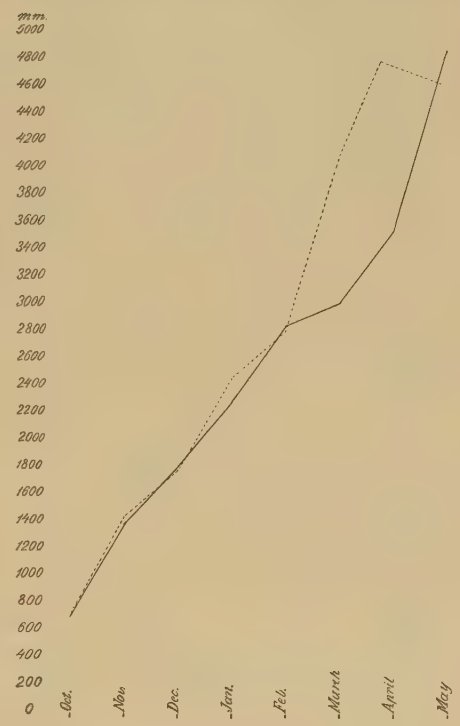

Figure 26. Average length of fin whale foetuses in the Southern Seas 1920—1925.
———— the Southern Seas.
- - - - - - South Georgia.

The smallest foetus of which the sex is recorded is a male 325 mm. long seen by Professor Guldberg at Vardö on the 28th May 1883; judging from this case it would appear that the general external form, including the external genitalia must be perfected by the time the foetus has acquired a length of 300 mm. Such completely developed foetuses cannot, in my opinion, be less than two months old, and they may well be older.

The length of the finner at birth appears to be about 20 feet or 6100 mm. After examining all the figures before me, I am inclined to think that the growth of the foetus from a length of 300 mm. to 6100 mm., or birth, occupies about nine months and it is not improbable that the growth during this latter nine months' gestation takes place at a fairly regular and equal rate.

The age, and consequently the "pairing dates" of each foetus has been calculated, therefore, as follows:

6100 mm. — 300 mm. = 5800 mm.

5800 mm.: the observed length of the foetus minus 300 mm.: 273 days: the days of growth subsequent to the completion of the preliminary development.

Figure 27. Average size of fin whale foetuses in the Southern Seas.

———— Average size.

- - - - - - — — — σ.

— · — · — — — + σ.

⊙ Maximum and minimum size.

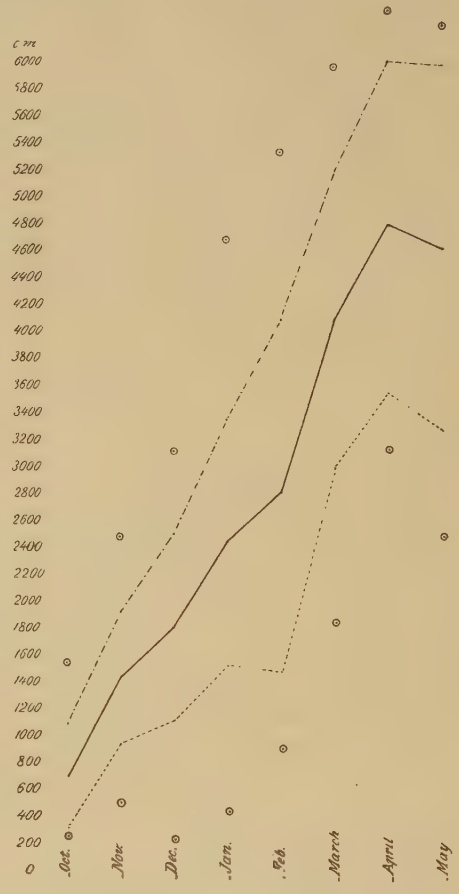

Figure 28. Average size of fin whale foetuses at South Georgia.

———— Average size.

- - - - - - — — — σ.

— · — · — — — + σ.

⊙ maximum and minimum size.

Age of foetus = x days of subsequent growth, plus 61 days of preliminary development".

On the basis of the above theory Mr. HINTON proposes a calculation of 104 foetuses for the northern Atlantic and 47 for South Georgia. He sums up the results in a table and says:

"In the above table all the foetuses enumerated in the list above are arranged

in the order of their "pairing dates". Further research is greatly to be desired, and it may show that the preliminary development of the foetus takes more than 61 days; that its subsequent growth occupies more or less than 273 days, and that the length of the finner at birth is more or less than 6100 mms. In these circumstances it will be understood that the "pairing dates" qua dates may have little or no value, and that at best they can only be regarded as purely tentative estimates; nevertheless, these dates are all subject to the same errors and so are fairly comparable; therefore they may, and in fact appear to afford valuable information regarding the nature and length of the breeding season of the finners".

The table resulting from HINTON's calculations is the following:

North Atlantic.

In	October	the number	of	pairings	is 2
-	November	- —	-	—	- 2
-	December	- —	-	—	- 4
-	January	- —	-	—	- 17
-	February	- —	-	—	- 38
-	March	- —	-	—	- 22
-	April	- —	-	—	- 11
-	May	- —	-	—	- 5
-	June	- —	-	—	- 2
-	July	- —	-	—	- ...
-	August	- —	-	—	- 1

Total... 104 pairings

South Atlantic.

In	July	the number	of	pairings	is 11
-	August	- —	-	—	- 28
-	September	- —	-	—	- 6
-	October	- —	-	—	- 1
-	November	- —	-	—	- 1

Total... 47 pairings

Mr. HINTON further states:

"From this summary it seems to be clear that both in the North and in the South Atlantic the great majority of the finners paired during a definite season. If the factors and methods used in computing the "pairing dates" be sound, this definite season must fall in the Spring, the rut apparently culminating in February in the Northern, and in the corresponding month of August in the Southern hemisphere".

With regard to the blue whale foetus HINTON puts forward a completely parallel theory and calculation. He writes:

"The ages of the blue whale foetuses and the possible dates of the pairing for them have been calculated as follows:

7500 mm. — 500 mm. = 7000 mm.

7000 mm.: the observed length of the foetus minus 500 mm.: 273 days: number of days of subsequent growth to the completion of the preliminary development.

Age of foetus = x days of subsequent growth, plus 91 days of preliminary development".

Hinton thus assumes a maximum size of the blue whale foetus of 7500 mms. He places the period of gestation of that whale of about 1 year and reckons with 91 days until the development of a definite size equals 500 mms. corresponding to a certain development of the foetus.

His materiel comprises 50 blue whale foetuses measured in the North Atlantic and 7 foetuses measured in the South Atlantic and the result of his calculations of the blue whale foetuses are thus parallel with the results of his calculations of the fin whale foetuses.

May I say at once that my own calculation of the large amount of material submitted in the present work confirms, on the whole, the results at which Hinton arrived. As will be seen I have to some extent employed somewhat different figures and a more summary method of procedure, but the results arrived at are, on the whole, the same. I will subsequently in the present work also include a considerable amount of material from the Northern Seas prepared on the same lines, and thereby have an opportunity of shewing that the pairing time in the Northern and Southern Seas shews quite parallel conditions as regards the season of the year.

Before I enter upon these conditions, however, I consider it advisable to regard a little more closely the kind of whale whose conditions of breeding are best known and most closely observed, just as it is the species of whale which undertakes the most regular and best known migrations, the gray whale (*Rhachianectes glaucus*), the Japanese Devil Fish, most often designated by whalers by the American name Californian Gray Whale.

This species of whale has been carefully observed by a number of skilled whalers, and it has also been the subject of scientific investigations. Thus Captain C. M. Scammon wrote about it in his book "The Marine Mammalia". Roy Chapmann Andrews subjected it to thorough investigations and the result of these is given in his large scientific work "The Californian Gray Whale".

The Norwegian whaler H. G. Melsom collected a number of observations of this species of whale and the last two years I have received measurements of whales and fetuses from Captain Otto Paust, who with the "Vega" expeditions has carried on whaling for the gray whale both off Mexico and Kamtchatka. I have also in the "Norsk Hvalfangsttidende" previously collected a number of facts regarding this species of whale.

From these I will quote the following:

"The study of the migrations of the gray whale, which on the basis of the

Vega expeditions to Mexico and Kamtchatka in the years 1925 and 1926 have thrown better, and to some extent, new light on the subject, are not only interesting *per se* but also throw light over the life and breeding conditions of other species of whale, species which on account of their more comprehensive and less known migrations are more difficult to study.

From all that is now known the gray whale is specially a Pacific whale which so far has not been observed South of the Equator. It appears to belong exclusively to the Northern Pacific where it undertakes regular migrations, both on the American and the Asiatic side".

In 1874 Captain C. M. Scammon published his book "The Marine Mammalia", and our previous knowledge of the gray whale was mainly based upon this book. The gray whale was at that time the object of regular hunting on the coast of the Californian Peninsula, but shortly after the appearance of the above book whaling began to decrease, and for a number of years it was merely maintained as a casual pursuit carried on by a number of Portuguese whalers off the coast of Lower California. Later on this whaling completely ceased; and in scientific circles it was generally assumed that the gray whale had been completely exterminated.

When the Norwegian whalers began to work off the coast of Japan and Korea, they found, however, a species of whale which the Japanese call "Koku Kujira" or "Devil Fish". This species of whale undertook very regular migrations, and it was the principal object of winter whaling on the South East Coast of the Peninsula of Korea.

Roy C. Andrews who stayed on that coast during the winter of 1911—1912 had an opportunity of hearing about this species of whale from Norwegian whalers. Subsequently he made a careful investigation of the species and soon proved that it was the "extinct" California Gray and that there were even considerable numbers of them.

In the course of many years of regular whaling in the Korean coastal waters it has been proved, as Roy C. Andrews also reports in his book, that the gray whale begins to appear at Ulsan on the South East coast of Korea towards the end of the month of November. The animals are then migrating southwards. First come a few pregnant females, but later when the shoal increases there are both males and females, although the females are still in the majority. At the end of the year there occur shoals which may consist of from 10—15 males. These follow 1—3 females, who as it were lead the migration of the shoal.

Andrews relates that "from the 7th to the 25th of January, when the migration is completed, only males are present, the females all having passed.

In November and December, when the females are taken, almost every individual will be found to be carrying young nearly ready for birth. As these would necessarily be delivered within two or three weeks after passing Ulsan, the

birth must occur in the bays among the numerous small islands at the extreme southern end of the peninsula. When travelling southwards the whales are always hurrying straight ahead as though anxious to arrive at the breeding grounds and are never accompanied by small calves; upon the northward migration, however, young have been seen following their parents.

The "Devil Fish" again arrives at Ulsan, travelling north, about the middle of March and by the 15th of May they have all passed by. Although the greater portion of the herd goes straight northward, Captain Melsom reports that during the end of April and first week of May he has observed many gray whales in Broughton Bay, Korea; these animals seemed to be feeding and had apparently broken the migration by a sojourn in the Bay".

It is interesting to compare this with what Scammon writes on the gray whale's appearance at the coast of California:

"The California Gray Whale is found only in north latitudes, and its migrations have never been known to extent lower than 20° North. It frequents the coast of California from November to May. During these months the females enter the lagoons on the lower coast to bring forth their young, while the males remain outside along the seashore. The time of gestation is about one year. Occasionally a male is seen in the lagoons with the females at the last of the season, and soon after both male and female, with their young, will be seen working their way northwards, following the shore so near that they often pass through the kelp near the beach. It is seldom they are seen far out at sea. This habit of resorting to shoal bays is one in which they differ strikingly from other whales. In summer they congregate in the Arctic Ocean and Okhotsk Sea. It has been said that this species of whale has been found on the coast of China and about the shores of the island of Formosa, but the report needs confirmation.

In October and November the California Grays appear off the coast of Oregon and Upper California, on their way back to their tropical haunts, making a quick, low spout at long intervals; showing themselves but very little until they reach the smooth lagoons of the lower coast, where, if not disturbed, they gather in large number, passing and repassing into and out of the estuaries, or slowing raising their colossal forms midway above the surface, falling over on their sides as if by accident, and dashing the water into foam and spray about them. At times, in calm weather, they are seen lying on the water quite motionless, keeping one position for an hour or more. At such times the sea-gulls and cormorants frequently alight upon the huge beasts. The first season in Scammon's Lagoon, coast of Lower California, the boats were lowered several times for them, we thinking that the animals when in that position were dead or sleeping, but before the boats arrived within even shooting distance they were on the move again.

As yet it is impossible to state whether or not the Korea and California herds mingle in the north during the summer. Information gathered from the

whalers tends to show that a large part of the former herd summers in the Okhotsk Sea and the latter in Berings Sea and further north. Individuals of the two herds may mingle and interbreed during their sojourn in the north, but it is probable that whales which have been born near either the Korea or California coasts will find mates among the members of their own herd during the southward migration and return annually to their birth place".

These observations from whaling activities of earlier times have now been further illustrated and confirmed by the observations of the "Vega" expedition. On the basis of the measurements and data of various kinds sent in from this expedition there has been procured a considerably increased material in this matter, where, formerly investigators had a comparatively scanty number of individual observations upon which to base their results.

In the first instance I remember that Ulsan from which Roy C. Andrews had most of his observations is situated on the South East Coast of the Korean Peninsula towards the Strait of Korea at about 35° North latitude.

Magdalena Bay, where the "Vega" expedition made a number of observations, is situated on the Californian Peninsula towards the Pacific between 25° and 24° North Latitude.

The difference in latitude is thus nearly 11°, and this may conceivably have the result that the whale migration, which of course in both cases comes from the North, is somewhat earlier off the Strait of Korea than at Magdalena Bay.

The "Vega" expedition commenced whaling at Magdalena Bay on November 14th 1924 and the adjacent whaling field was investigated every day by 4 whaling boats. The catch consisted of humpbacks every day. It was not until December 27th that a gray whale was caught, a female. In 1925 the first gray whale was caught on December 29th and in 1926 on December 28th. In 1925 the field was investigated every day by 8 whaling boats and in 1926 by 9. However, before the period stated no gray whales were seen. We can, therefore state that the gray whale does not appear off that coast before about December 28th. However there was no regular migration of gray whales in any of the 3 years mentioned.

I will now keep to the whaling season 1924—1925 as for that season there are available the largest number of measurements. The conditions, however, are parallel in later seasons.

On January 4th 1925 there began to appear a more regular migration of gray whales. They consisted of females, and most of those caught had almost fully grown foetuses.

January	4th	there	was	caught	1	female	with	a foetus	16	feet	long
—	5th	—	—	—	1	—	—	—	15	—	—
—	6th	—	—	—	1	—	—	—	17	—	—
—	10th	—	—	—	1	—	—	—	16	—	—
—	11th	—	—	—	3	—	—	—	17	—	—

The first male, a gray whale, was caught in January. The migration then continued throughout the month and by degrees the males became more numerous. In all 62 gray whales were caught in January, of which 28 were males. About January 22nd the migration was at its height, and on that day the report says "a large number of gray whales are now moving southwards". Four days earlier, on January 18th the report says "the gray whale steadily travelling southwards".

The migration continued, but decreased during the month of February, and the last gray whale was caught on February 16th. In all 20 gray whales were caught in February, 18 of which were males.

Regarding the size of these animals we have the following figures:

30	feet	3	males	and	1	female	=	4 animals
32	—	6	—	—	0	—	=	6 —
33	—	2	—	—	0	—	=	2 —
34	—	11	—	—	3	—	=	14 —
35	—	5	—	—	11	—	=	16 —
36	—	11	—	—	5	—	=	16 —
37	—	1	—	—	2	—	=	3 —
38	—	4	—	—	6	—	=	10 —
39	—	1	—	—	2	—	=	3 —
40	—	2	—	—	3	—	=	5 —
41	—	0	—	—	2	—	=	2 —
42	—	0	—	—	1	—	=	1 —

Total 46 males and 36 females = 82 animals

The foetuses found were nearly all fully grown and varied in size from 15 to 17 feet. This clearly indicates that this species of whale has a more definite period of pairing than any of the other large baleens.

The "Vega" expedition did not come in touch with the Northern migration of the gray whale, since it left Magdalena Bay on April 7th. Neither had the "Mexico's" expedition any contact with the northward migration of the gray whale the following year, although it stayed in those waters until June 19th. The catch consisted of the more valuable blue whale, which was comparatively far from the coast, so that no very close watch was kept upon the gray whale at that period.

On the 9th of June of the same year the "Vega" expedition began to catch off the East Coast of Kamtchatka. Whaling was carried on at various parts of the coast, and from the middle of July and onwards Nathalia Bay was employed as a base. On July 27th there arrived a shoal of gray whales of a quite considerable size, so that from July 27th to August 22nd 31 animals were caught. They were of a quite different character as will be clearly seen from the following figures:

25 feet	0	males	and	1	female	=	1	animal
26 —	1	—	—	1	—	=	2	—
27 —	2	—	—	0	—	=	2	—
28 —	0	—	—	1	—	=	1	—
29 —	0	—	—	1	—	=	1	—
30 —	2	—	—	2	—	=	4	—
31 —	1	—	—	0	—	=	1	—
32 —	5	—	—	1	—	=	6	—
33 —	5	—	—	3	—	=	8	—
34 —	2	—	—	2	—	=	4	—
36 —	1	—	—	0	—	=	1	—
Total	19	males	and	12	females	=	31	animals

The animals are thus smaller although of course some attempt was made to catch the largest animals, and it must be obvious that a number of them consist of the year's young ones. We have, therefore, here one of those observations which give us an insight into the rate of growth of these animals, just as it can undoubtedly be employed in respect of large species of whales in general. I will first quote what ANDREWS stated regarding these conditions ("The California Gray Whale"):

"Because of its regular annual migrations the period of gestation of this species can be more nearly determined than in the case of most other large whales, and appears to be about one year. Mating probably takes place in the south during December or early January, and the calf is ready for delivery the following year".

As stated above, the females which appear at Ulsan, Korea, travelling southward are nearly all bearing calves almost ready for birth. Upon the return journey the females are accompanied by young calves, and Captain H. G. MELSOM writes that he killed on March 13th and 14th, 1912, at Chan Chien Dogo (near Broughton Bay), Korea, upon their northward migration, two females bearing foetuses 7 and 10 inches long, respectively. These foetuses were probably not more than $2^1/_2$ months old, which would indicate that the mating had taken place late in the previous December and that the calves would be delivered the following December or January when the whales returned to the South. A female 1300 cms. (42′ 8″) in length taken at Ulsan on January 8th contained a foetus 476 cms. (15′ $7^1/_2$″) long, and ready for birth; it would certainly not have been carried more than a week or ten days longer.

Whether or not the females again mate immediately after giving birth to their young, it is impossible to state, but from SCAMMON's observations, quoted below, I believe it to be unlikely and that calves are born but once in two years.

SCAMMON says that the period of gestation is about one year, and remarks: "This statement is maintained upon the following observations: We have known of five embryos being taken from females between the latitudes of 31° and 37° north, on the California coast, when the animals were returning from their warm winter haunts to their cool summer resorts, and in every instance they were ex-

ceedingly fat, which is quite opposite to the cows which have produced and nurtured a calf while in the lagoons; hence we conclude that the animals propagate only once in two years."

Mr. C. H. Townsend, writing in 1886 of the San Simeon (Cal.) Station says: "Unlike Monterey, this station depends almost entirely for its business upon the Gray whales, which pass southward with great regularity from December until February. The "up season", lasting until April, is also profitable at San Simeon, but the catch there consists chiefly of males, the females keeping farther off shore when passing northwards with their young. During the last ten years Captain Clark has seen but one female accompanied by young in the vicinity of his station. At San Simeon, and all the whaling establishments situated south of it, females exceed the six in numbers during the "down run" and most of them contain well-developed young. At this place and at San Luis Obispo, the nearest neighbouring Station, I saw four young whales lying on the beach, which had been taken from females killed in the vicinity during that season (December 1885). Their average length was about 12 feet, the largest, which I sketched, being 17 feet long, and from an adult nearly 40 feet in length. They were probably within two weeks of the time of birth when the parent animals were killed."

"From the above data it may be safely affirmed that the length at birth of the majority of Gray Whales is between 12 and 17 feet. When the females go north in March on the Korea coast, the calves which have been born near the end of the previous December accompany them, and by the time they reach Ulsan are about twenty five feet in length, this makes a growth of nine or ten feet during a little less than three months. This may seem extraordinary, but it is quite in accord with what apparently takes place in all baleen whales. Without doubt the rate of growth for the calf is very rapid during the first few months after birth and until sexual maturity is reached.

Thirty-two feet is the minimum length for Gray Whales taken at Ulsan, and individuals of this size must certainly have been born during the previous winter. Thus, accepting 14 feet as the average length at birth, we get a growth of 18 feet during a little less than one year.

How long the young nurse is problematical, but it must be considerably less than one year because, so far as I am aware, nursing calves or females have not been taken at Ulsan on the southward migration, and some would certainly have been brought in if the suckling period was not over before the animals reached that point upon the coast."

I will now revert to the measurements of the "Vega" expedition off the coast of Mexico in January 1925 with the object of comparing the observations of that expedition with those already reported from the coast of Korea and with earlier observations on the coast of the Peninsula of California (Mexico).

On the whole it is a fact that the observations of the "Vega" expedition

confirm what is quoted above, but in one or two cases observations were made which, to some extent, differ from the conditions and conclusions just reported.

With the exception of one animal (December 27th) no gray whales were observed off the coast of Mexico before January 4th. But the fact that the migration was somewhat later than that off the coast of Korea may, as already observed, possibly be explained by the considerably greater distance which the animals had to travel from their summer place in the Arctic Region to their breeding place off the coast in question.

During the period between January 4th and January 20th there were caught in all 14 females ready to calve. After that time none were caught, since the shoal which afterwards was most numerous consisted exclusively of males and unimpregnated females. On February 16th the migration had evidently come to an end, since all the animals appear to have passed Magdalena Bay.

The foetuses measured from January 4th to January 20th were all of a length from 15 to 17 feet, (from 1926 there is forthcoming a measurement from that coast of a gray whale foetus 18 feet in length) and it must be definitely assumed that these foetuses would have been born within the period January 10th—January 31st. All births in that year must have taken place in the month of January.

It is thus an undoubted fact that, according to the observations made, the great majority of pairings took place in the latter half of January. It is quite unlikely that the female who had just given birth would again pair immediately afterwards. They have been occupied in feeding their young ones and took no part in the "love play" of the rest of the flock. Those females who had just become mothers were of course much fatter than those females who had no foetus on the southern migration. This agrees entirely with SCAMMON's observations. When, on the other hand, ROY C. ANDREWS states that the majority of newly born gray whales must be between 12 and 17 feet long this appears to be a far too large interval in size, in that, in accordance with the measurements of the "Vega" expedition, we should be inclined to fix 15—17 feet as the extreme limits, and should thus be able to reckon with an average size of about 16 feet for the gray whale born in January. It must not be forgotten, however, that the measurements are so few that in estimating the size it is easy to fall into error. Cases of exceptional development are found in the gray whale, as in the other whales, but to this definitely limited time of pairing few have been observed. On the 9th January 1926, however, in the same field the Mexico Expedition obtained a gray whale foetus only 8 feet in length. This foetus was of course far from being fully developed.

The smallest gray whales caught on the "Vega" expedition in 1925 off Mexico were three males and one female 30 feet long. They were captured between January 23rd and February 16th. There cannot be the slightest doubt that they were born the previous year, and must have been about 1 year old. If the assumption as to an average length of about 16 feet at birth is correct, the animals must have grown

about 14 feet during a maximum period of one year. In other words, they practically doubled their length during the course of the first year of their existence.

It is, however, extremely probable that most of this growth took place during an even shorter period.

6 months after the time when, in accordance with the information just given, the gray whale females must be assumed to have ended their calving period off the coast of Mexico, the "Vega" expedition was engaged in whaling from Nathalia Bay on the coast of Kamtchatka. As already mentioned the expedition met there a number of gray whales the measurements of which I have already given. During the period, July 27th to August 22nd there were caught *inter alia* 11 animals measuring 30 feet and less, the size varying between 25 and 30 feet. There is no doubt that these animals were born the same year.

The question as to how many months old these animals were, however, is not quite settled. Where were these animals born?

Were they born off the coast of Mexico in the month of January, or were they born off Korea at the end of November or during the first half of December?

In the first instance these animals would have an age of 6—7 months, in the latter instance they must be assumed to have been on an average at least one month older.

Captain H. G. Melsom, who must be regarded as the greatest authority on the question of the migration of gray whales, writes to me:

"I scarcely believe there can be any doubt as to where these young ones come from. The gray whale from Korea treks northward through the Strait at Sachalin and in the Bays in the Okhotsk Sea and as a rule does not proceed towards the south or north of the east coast of Kamtchatka. My idea is that the young ones off Korea were born in December, and at the end of April and the beginning of May they were about 25—30 feet in length. I never shot them, however, because I considered them to be too small. The young ones 25—30 feet in length, which the "Vega" expedition caught at Kamtchatka were undoubtedly born off the coast of Mexico in January of the same year. I myself one summer saw the Bays of the West coast of the Okhotsk Sea full of gray whales."

I assume that this is correct. Melsom has had many years experience in these waters upon which to base his statements. But even though it is not correct, and even if it is a fact that the whales from Korea and Mexico mix in the summer off the coast of Kamtchatka, that would only make a difference of one month in age. These young animals 25—30 feet in length, must be at least 6 months, and at the most 8 months old. Thus the measurements made by the "Vega" expedition off the coast of Kamtschatka provide a further proof of the theory already put forward by American authors that the gray whale after not more than 6 months attains a size of 25 feet or even somewhat more, and that the animal at the end of its first year of existence attains a size of 30—32 feet. Thus far the matter seems

to be quite clear. What then is the course of their further development? In my material from the "Vega" and Mexico obtained off the coast of Mexico I have figures shewing the size of 23 gestating females. The size is given as follows:

34	feet	1	gestating	female
35	—	5	—	—
36	—	1	—	—
38	—	4	—	—
39	—	1	—	—
40	—	3	—	—
41	—	2	—	—
42	—	2	—	—
44	—	3	—	—
50	—	1	—	—

The smallest of these gestating females was thus 34 feet. It was shot on January 2nd 1926 and had a foetus which was nearly fully developed. This female must thus have paired for the first time, judging from the development of the foetus, at the end of January or the first half of February the previous year. Thus it was not much more than one year old. The case is not unique. The females measured here, 35 and 36 feet in length, are undoubtedly animals giving birth for the first time. We thus arrive at the result that the female gray whale arrives at puberty at an age of a little more than one year.

From what has been stated it must be considered settled that whilst the growth of the gray whale during the first year until the age of puberty takes place very quickly, it afterwards only proceeds slowly. There are circumstances indicating that growth only amounts to 2—3 feet annually during the first years onwards and that later it is even more slow.

The conditions of development of this species of whale during the first years of its life thus appear to be somewhat clear, and it seems reasonable to suppose that these periods of development may to a certain extent also be applied to the other large Baleens.

It would be of the greatest interest if we could elucidate the parallel conditions of development and growth in that large species of whale which, after the gray whale, has the most regular and best known migrations, namely the humpback.

In previous works I have put forward a quantity of material regarding the migrations of this species of whale, and the results at which I then arrived are doubtless correct on the whole. On the other hand, I have never had an opportunity of publishing foetus measurements of this species of whale, because there was insufficient material upon which to base such calculations. When in the year 1905 and onwards the great humpback whaling in the Southern Seas was carried on, there was, as far as I am aware, no one who to any appreciable extent undertook measurements of the foetuses found. There was on that occasion an opportunity

of making measurements by the hundred, but the opportunity was neglected and will never recur. Then when the great humpback whaling began along the coast of Africa in 1908, there would have been a splendid opportunity of supplementing these measurements. But that also was not done, at least not to the extent which would have been desirable. There was then an opportunity of collecting measurements of foetuses from every month of the year, and very interesting material might have been collected to elucidate the conditions of development and growth of the humpback.

It is true that in the course of years a number of measurements of humpback foetuses have been made, but they are far too few to allow any certain conclusions to be based upon them. The same is also the case with the few measurements which I have collected in recent years from Norwegian whalers in various fields.

In the previously mentioned material from the Southern Seas there occur only 24 measurements of humpback foetuses; but although the material as stated is quite insignificant, I desire to include it here, and I have arranged it in accordance with the time of the year when the mother animal was captured.

Date	Size of mother animal	Size of foetus
$^{3}/_{11}$ 1925	48 feet	0 feet 3 inches = 78 mm.
$^{9}/_{11}$ 1923	49 —	0 — 7 — = 183 —
$^{18}/_{11}$ 1924	50 —	8 — 0 — = 2512 —
$^{19}/_{11}$ 1923	46 —	0 — 7 — = 183 —
$^{9}/_{12}$ 1924	46 —	1 — 6 — = 471 —
$^{9}/_{12}$ 1924	49 —	0 — 8 — = 209 —
$^{11}/_{12}$ 1924	51 —	2 — 0 — = 628 —
$^{16}/_{12}$ 1925	52 —	8 — 0 — = 2512 —
$^{16}/_{12}$ 1924	43 —	0 — 5 — = 130 —
$^{22}/_{12}$ 1924	51 —	1 — 6 — = 471 —
$^{29}/_{12}$ 1924	45 —	2 — 0 — = 628 —
$^{10}/_{1}$ 1926	45 —	1 — 8 — = 523 —
$^{15}/_{1}$ 1926	49 —	2 — 0 — = 628 —
$^{19}/_{1}$ 1926	57 —	1 — 3 — = 392 —
$^{19}/_{1}$ 1926	45 —	9 — 0 — = 2826 —
$^{24}/_{1}$ 1923	47 —	2 — 0 — = 628 —
$^{24}/_{1}$ 1926	44 —	3 — 6 — = 1099 —
$^{28}/_{1}$ 1925	45 —	3 — 0 — = 942 —
$^{3}/_{2}$ 1926	49 —	7 — 0 — = 2198 —
$^{4}/_{2}$ 1926	42 —	4 — 0 — = 1256 —
$^{27}/_{2}$ 1925	48 —	2 — 0 — = 628 —
$^{28}/_{2}$ 1925	40 —	3 — 0 — = 942 —
$^{5}/_{3}$ 1925	40 —	2 — 6 — = 785 —
$^{5}/_{4}$ 1926	50 —	6 — 0 — = 1884 —

These figures do not tell us much. They only shew that the humpback also can pair at various times of the year and that the vast majority of pairings take

place during a definitely short limited period. The average size of the foetus increases as the season advances. This, however, is not so apparent as in the case of the larger species, namely the blue whales and fin whales.

The average size of the humpback foetuses was:

$^{3}/_{11}$ to $^{15}/_{12}$:	7	foetuses, average	size	609 mm.
$^{16}/_{12}$ - $^{15}/_{1}$:	6	—	—	— 815 —
$^{16}/_{1}$ - $^{15}/_{2}$:	7	—	—	— 1334 —
$^{16}/_{2}$ - April:	4	—	—	— 1060 —

I have only four measurements from the northward trek along the coast of West Australia of the humpbacks. They all shew foetuses 15 feet in length (4710 mm.) during the period July 10th—August 18th. I have no measurements from the northward trek of the humpbacks along the coast of West Africa.

I have four measurements from Walvis Bay of the southward trek along the coast of West Africa of the humpbacks. They give the following measurements:

$^{22}/_{10}$ 1925:	1	foetus	0	feet	7	inches	=	183 mm.
$^{28}/_{10}$ 1925:	1	—	0	—	5	—	=	130 —
$^{28}/_{10}$ 1925:	1	—	0	—	6	—	=	157 —
$^{1}/_{11}$ 1925:	1	—	0	—	4	—	=	104 —

From Hangklip I have the following interesting observations of the south going trek of the humpbacks:

$^{31}/_{10}$ 1913:	a female	was	caught	47	feet	accompanied by a	young one	28 feet
$^{1}/_{11}$ 1913:	—	—		48	—	—	—	24 —
—	—	—		42	—	—	—	23 —
$^{10}/_{11}$ 1913:	—	—		50	—	—	—	29 —
$^{15}/_{11}$ 1913:	—	—		46	—	—	—	29 —
$^{18}/_{11}$ 1913:	—	—		46	—	—	—	28 —
$^{19}/_{11}$ 1913:	—	—		48	—	—	—	29 —

The female which was shot accompanied by its young one on November 15th was again gestating with a foetus 5 inches in length (130 mm.). This is the only certain case I know in any of our species of whales which indicates that a whale can have a foetus in two successive years.

It appears from the above mentioned observations that the humpback principally gives birth to its young ones and pairs in the warmer regions of the sea during the period June—September.

There is also present in my material from later years a number of scattered measurements from various other parts of the sea, but the measurements from each field are so few in number that I consider them to be of minor interest.

Blue Whale Foetuses.

After the above observations regarding the foetuses of gray whales and humpbacks I will now return to the previously submitted material regarding the foetuses of blue whales.

The smallest blue whale foetuses in the material to hand are two foetuses measured at South Georgia in 1923:

Foetus measured $^{20}/_{12}$ 1923, length 10 inches = 261 mm.
— — $^{27}/_{12}$ 1923, — 10 — = 261 —

In the material which was collected during the whaling season 1925—1926 and which has not been included in the measurements of foetuses given here, there occurs, however, a blue whale foetus only 3 inches (78 mm.) in length. It was found at South Georgia, November 6th 1925 and was taken from a mother animal which had a length of 68 feet = 21.34 metres. The largest foetuses in the material produced are two foetuses measured at South Shetlands.

Foetus measured $^{5}/_{4}$ 1923, length 27 feet = 8478 mm.
— — $^{17}/_{3}$ 1925, — 27 — = 8478 —

As regards these foetuses it is stated that they appear to be fully grown. There also occur in the material:

Foetus measured $^{23}/_{3}$ 1925, length 25 feet = 7850 mm.
— — $^{20}/_{4}$ 1925, — 25 — = 7850 —
— — $^{6}/_{4}$ 1923, — 24 — = 7536 —
— — $^{21}/_{5}$ 1923, — 24 — = 7536 —

In the measurements of foetuses from earlier years collected more by chance there is also found one "at least 26 feet" in length.

It may therefore be assumed that the young blue whale at birth has a length of about 25—27 feet. I have several times asked those who measured blue whale foetuses 23—24 feet in length whether they had the impression that the foetus was ready for birth: but those concerned considered that this could not yet be the case. I am, however, fully aware that this kind of statement by amateurs cannot be given any appreciable importance.

It is, however, easily understandable that even more expert observers, when there is a question of a foetus about 27 feet in length, may arrive at the result that the period of gestation must be longer than one year, e. g. 14—15 months or more.

The existing material of measurements, however, indicates quite distinctly that there is a period of gestation not essentially exceeding one year.

If, for instance, it is assumed that a very considerable number of pairings take place in the month of August, we may expect in the months of September,

October and November to meet two different sets of foetuses, one of quite small animals such as is now the case, and another, almost equally numerous, of larger almost fully grown foetuses.

But pairing is not concentrated in one month, for, as I will soon show it may undoubtedly be assumed that it is especially concentrated during a definite period of the year, in the case of the Southern Hemisphere during our summer, namely the months of June, July, August and partly September. But also under this assumption it is inevitable that we should notice the two sets especially during the autumn months if it is conceivable that the whale has a period of gestation of e. g. 15 months or more. We should then of course find a number of fully grown foetuses in the months of October, November and December. But the measurements of such foetuses are not found for these months in the whole of the large amount of material submitted either for blue whales or fin whales. The steady growth in the average length from month to month of the foetuses measured also is decided evidence against the theory that there occur two sets of foetuses in certain months of the year and not in others.

If we accept such an unlikely hypothesis as a period of gestation of 2 years, this would doubtless not cause difficulties in explaining the even average growth, but there would then inevitably be found two sets of foetuses in every month of the year, and this is not the case.

In a month like December it would be expected that this would be especially noticeable. Herr Lange-Nielsen, therefore, drew up a "curve of frequency" comprising the 156 blue whale foetuses measured in that month. See Curve on page 65. This clearly shews that in the occurence of foetuses there can be no question of differentiating two distinct sets, which again serves to confirm the idea that the period of gestation in blue whales cannot exceed one year, in any case not to an appreciable extent.

From what I have previously stated regarding the gray whale, I consider it as settled that the period of gestation in this species of whale can be fixed at one year. It now appears improbable that the period of gestation in the larger species of whales could be appreciably shorter. The few measurements of foetuses and observations of the humpback also point definitely in the direction of a period of gestation of about one year, and I therefore consider that the period of gestation in the fin whale and blue whale also cannot be assumed to be shorter. In my subsequent calculations I thus assume a period of gestation of 360 days both for the blue whale and the fin whale; in so doing I consider that the error of which I am possibly guilty is so small that it is of minor importance.

I will now on the basis of a similar method to that employed by Mr. Hinton and earlier described in this section, make an attempt to reach a result regarding the time of the year when pairing principally takes place amongst blue whales and fin whales.

As I consider it would take too long to estimate the time for each one of the foetuses measured, I have employed another and more summary method. The fact is it seems to me to be of minor importance to be able to fix the exact "day of pairing". My object is only to make an attempt to determine the approximate time of pairing in order thereby to prove that the blue whale and fin whale, although pairing may take place throughout the year, in the vast majority of cases pair during a short and limited period.

I therefore take as my basis the already mentioned average measurements and standard average, in that I reckon from the middle of the month concerned. I thereby commit an error which, in certain cases, may amount to 15 days, but which as I have already said I consider to be of subordinate significance. I obtain by my calculation the average day of pairing for five months. I then put in parenthesis the period which comes between 15 days before and 15 days after this average day. Thus, for instance, if the average day of pairing in a certain month is found by calculation to be the 15th, the pairing must have taken place between the first and 30th of the same month.

The basis of my calculation is the following: I assume an average size for the new born blue whale of about 26 feet = about 8100 mm.

At Commander Chr. Christensen's Whale Museum at Sandefjord there are two foetuses about 100 mm. in length. These had advanced so far in their development that it is possible to determine their species and sex. In order to have a starting point I take the time which has been taken for this development as 60 days, for I assume what must necessarily be the case, namely that development in this first period must take place considerably more slowly than during the later stages of the foetus period. I further assume in my calculations that the foetus requires another 30 days in order to reach an additional 400 mm. or so in length. I thus arrive at a size of 500 mm. in the course of 90 days.

I am further of the opinion that the foetus still increases less in length per day than during the later stages of the foetus period, but in my calculations I have assumed an approximately even growth.

The calculation is thus as follows:— 60 days for the first 100 mm. and 30 days for the next 400 mm.: a total of 90 days for the first 500 mm. At birth a blue whale is 8100 mm. in length and, as explained above, the total period of gestation is reckoned at 360 days. Then if 90 days are occupied in the growth of the first 500 mm., 8100 minus 500 mm., = 7600 mm. is the increase in length during the remaining 270 days. Assuming an even growth in the later development, the increase above 500 mm. is thus at the rate of rather more than 28 mm. per day.

If this method of calculation is then applied to the total material (page 50—54), 593 foetuses from the whaling fields of the Southern Seas, I arrive at the following results regarding the time of pairing:

October...	21	fetuses,	average	length	1779	mm.	day of pairing	$^{1}/_{6}$ ($^{16}/_{5}$—$^{16}/_{6}$)
November.	74	—	—	—	1745	—	—	$^{4}/_{7}$ ($^{20}/_{6}$—$^{19}/_{7}$)
December.	156	—	—	—	2279	—	—	$^{15}/_{7}$ ($^{1}/_{7}$—$^{30}/_{7}$)
January ..	139	—	—	—	2679	—	—	$^{1}/_{8}$ ($^{16}/_{7}$—$^{15}/_{8}$)
February .	81	—	—	—	3427	—	—	$^{5}/_{8}$ ($^{20}/_{7}$—$^{20}/_{8}$)
March	70	—	—	—	4515	—	—	$^{25}/_{7}$ ($^{10}/_{7}$—$^{9}/_{8}$)
April	47	—	—	—	4222	—	—	$^{5}/_{9}$ ($^{21}/_{8}$—$^{20}/_{9}$)
May.....	5	—	—	—	5400	—	—	$^{24}/_{8}$ ($^{9}/_{8}$—$^{8}/_{9}$)

It thus appears that if in calculating the "pairing day" we take as our basis only the average length calculated for each month, we arrive at the result that all the pairings (total 593) must have taken place between May 16th and September 20th, i. e. a period of about 4 months. If we take away the foetuses measured in October (21), April (47) and May (5), total 73 foetuses, we even arrive at the result that of the 593 foetuses measured 520 or about 88 % were conceived during the period between June 20th and August 20th, i. e. about 2 months.

This result, however, does not give a true picture, since no regard whatever is paid to the great divergence in the sizes of the foetuses which has already been discussed and proved. In order to arrive at a workable result we must therefore take the already discussed divergence to assist us in calculating the time of pairing.

Figure 21. B. page 64 gives a representation of the divergence of the foetus measurements. It appears from the figure that the average length (*av*) plus the standard average (σ) for the month of October amounts to 3065 mm. and the average length minus the standard average 260 mm. The corresponding table (Table 38) shews that of all the measurements for that month 80 % were within these extreme limits.

In accordance with the method of calculation just described, a foetus of 3065 mm. measured on October 15th should have been conceived on April 17th, just as a foetus 260 mm. measured on October 15th should have been conceived on August 4th. 80 % of the foetuses measured in October should thus have been conceived during the period April 17th—August 4th.

If the same method of procedure is now applied in the case of the other months of the whaling season, we obtain the following result:

Table 38.

Month	Average plus σ	Calculated pairing day	Average minus σ	Calculated pairing day	Total foetuses	Total measurements between av. plus σ and av. minus σ given in %
October.....	3065 mm.	$^{17}/_{4}$	260 mm.	$^{4}/_{8}$	21	80 %
November.....	2640 —	$^{2}/_{6}$	820 —	$^{6}/_{8}$	74	81 -
December.....	3400 —	$^{5}/_{6}$	1160 —	$^{23}/_{8}$	156	71 -
January	3830 —	$^{21}/_{6}$	1530 —	$^{11}/_{9}$	139	76 -
February	4870 —	$^{14}/_{6}$	1990 —	$^{25}/_{9}$	81	60 -
March	6000 —	$^{3}/_{6}$	3040 —	$^{16}/_{9}$	70	71 -
April	5780 —	$^{11}/_{7}$	2670 —	$^{30}/_{10}$	47	72 -
May.....	7500 —	$^{10}/_{6}$	3190 —	$^{10}/_{11}$	5	80 -

By estimating for each month the number of foetuses which are between av. plus σ and av. minus σ we find that the total number within these limits is 430 foetuses. As the total number of foetuses measured was 593 there is thus a remainder of 163 foetuses which fall outside the limits set.

As will be seen from the above table these limits are indicated by the two periods April 17th and November 10th. In the time within these extreme points there were thus conceived 430 of the 593 foetuses measured, or in all about 72.5 %.

If we also disregard the comparatively few foetuses from October (21), April (47) and May (5) we have left 357 foetuses or about 60 % of the total number, which in accordance with my method of calculation must have been conceived between June 2nd and September 25th a period of about $3^2/_3$rds months, corresponding to the winter months of the Southern Hemisphere.

I will now apply the same calculation and method of procedure to the blue whale foetuses measured at the permanent stations in South Georgia, which I consider to be the most valuable part of this material, since I will eliminate the calculation of the "pairing day" estimated on the basis of the average length for each month. The fact is, I have already shewn, that this calculation is of little value because it does not take into account the divergence of the sizes of the foetuses around the average.

I will thus keep to the measurements of divergence which are represented in figure 22. C. (p. 64) and to the statistics in the table (Table 39) which form the basis of the said figure.

Table 39.

Month	Average plus σ	Calculated pairing day	Average minus σ	Calculated pairing day	Total foetuses	Total measurements between av. plus σ and av. minus σ given in %
October.....	1640 mm.	$^6/_6$	640 mm.	$^{12}/_7$	17	76 %
November.....	1980 —	$^{25}/_6$	900 —	$^3/_8$	44	68 -
December.....	3140 —	$^{14}/_6$	1200 —	$^{22}/_8$	95	73 -
January	3720 —	$^{25}/_6$	1900 —	$^{28}/_8$	55	64 -
February	5210 —	$^3/_6$	2610 —	$^3/_9$	32	63 -
March	6140 —	$^{29}/_5$	3930 —	$^{15}/_8$	28	79 -
April	6100 —	$^{21}/_6$	3500 —	$^{21}/_9$	7	71 -
May.....	not included		not included		3	67 -

It here appears that of 281 measurements of foetuses taken at the permanent shore stations in South Georgia 196 are within the limits of size which are indicated by av. plus σ and av. minus σ. In accordance with the method of calculation previously explained these 196 foetuses should have been conceived in the time between May 29th and September 21st. I have not included the foetuses measured in May. The number is so small (3) that it gives no idea. If we also disregard the

seven measurements of foetuses from the month of April we have the result that of the 281 foetuses of the material 189 or over 67 % were conceived during the period May 29th to September 3rd, a period of at least 3 months, the winter of the Southern Hemisphere. It is observed that in calculating "the pairing day" for the foetuses measured in the month of April I have not taken as my base April 15th, but April 6th, because no foetuses were measured after April 10th.

As will be observed, the results to which I have arrived by my calculations of the large amount of material submitted agree quite well with the results arrived at by Martin A. C. Hinton in his estimation of the material already mentioned in the present work concerning 47 fetuses from the S. Atlantic.

I therefore consider that the following must be regarded as being completely proved:

1) The blue whale can pair at practically speaking any time of the year.
2) The bulk of pairings takes place, however, in the months of June, July and August, which are the winter months in the Southern hemisphere.

If these results are compared with what I have previously put forward in this work regarding the occurrence of the blue whale in the Southern Seas, it follows:

1) Pairing of the blue whale may take place also during the times when the animals usually stay in the whaling fields of Antarctic.
2) The vast majority of pairings takes place, however, at times when the blue whale stays in more temperate waters, outside the present whaling fields of the Southern Seas.

I will now pass over to my calculations regarding fin whale foetuses measured in the whaling field of the Southern Seas.

The smallest fin whale foetuses in the material produced are the following:

Foetus measured $^{8}/_{11}$ 1924 length 4 inches = 104 mm.
— — $^{21}/_{2}$ 1923 — 8 — = 209 —

The first of these foetuses was measured at South Georgia and the other at South Shetland.

In the material which was collected during the whaling season 1925—1926 and which is not included in the list of foetus measurements given here, there occur, however, a fin whale foetus $2^{1}/_{2}$ inches = 65 mm. in length. It was found on October 26th 1925 at South Georgia and taken from a mother animal whose length was 68 feet = 21.34 metres.

The largest foetuses in the material submitted are the following:

Foetus measured ..... $^{21}/_{4}$ 1921 length 21 feet = 6594 mm.
Several foetuses measured April—May — 20 — = 6280 —

In the material which was collected for the season 1925—1926 there occur, however, a fin whale foetus 22 feet = 6908 mm. in length. It was found in April 24th 1925 and was taken from a mother animal whose length was 71 feet = 22.28 metres. Regarding this foetus it is stated that it appeared to be fully developed.

I have no measurements exceeding 21 feet from earlier and more chance statistics.

I will not repeat here what I have just written regarding blue whale foetuses but I will restrict myself to stating that also in the case of the fin whale I have arrived at the results that the period of gestation cannot be appreciably more or less than one year. I have not found any support whatsoever for the assumption that the period of gestation of fin whales is shorter than that of the blue whale. I therefore place the period of gestation for this species of whale also at 360 days.

In my estimations of the "pairing day" I have employed the following measurements:

Estimated average size of the young fin whale at birth = 6500 mm.
— time to reach a length of 100 mm. = 60 days
— — - — a new length of 300 mm. = 30 days

It is thus estimated that after the expiry of 90 days the foetus attains a length of 400 mm.

Then, 6500 mm. minus 400 mm. = 6100 mm. which gives the increase in growth in the next 270 days which then remain of the full period of gestation.

The age of the foetus should thus be 90 days plus $^{6100}/_{270}$.

If this method of calculation is used for the collected material (page 67—70). for 462 foetuses from the whaling fields of the Southern Seas, I arrive at the following result regarding the time of pairing; in so doing I ignore the calculation of the "pairing day" on the basis of the average measurements for each individual month of the whaling season, and only retain the estimated divergence measurements and the limits arising therefrom.

Figure 27 (p. 78) gives a representation of all the measurements of fin whales foetuses in the Southern Seas. The middle line gives the average size (av.). The

upper line gives the average size plus the square divergence (av. plus σ). The lower line gives the average size minus the square divergence (av. minus σ). On the basis of this representation and the accompanying table (Table 40), there occurs the following:

Table 40.

Month	Average plus σ	Calculated pairing day	Average minus σ	Calculated pairing day	Total foetuses	Total measurements between av. plus σ and av. minus σ given in %
October.....	1120 mm.	$^{15}/_{6}$	330 mm.	$^{24}/_{7}$	14	71 %
November.....	1920 —	$^{11}/_{6}$	900 —	$^{26}/_{7}$	50	72 -
December.....	2610 —	$^{10}/_{6}$	1070 —	$^{17}/_{8}$	56	70 -
January	3200 —	$^{15}/_{6}$	1340 —	$^{5}/_{9}$	89	69 -
February	4190 —	$^{2}/_{6}$	1510 —	$^{29}/_{9}$	84	70 -
March	4220 —	$^{29}/_{6}$	1830 —	$^{13}/_{10}$	107	73 -
April	4920 —	$^{29}/_{6}$	2180 —	$^{28}/_{10}$	52	67 -
May.....	6160 —	$^{4}/_{6}$	3600 —	$^{25}/_{9}$	9	44 -

It appears from this calculation and table that of the 461 fin whale foetuses measured in the various fields of the Southern Seas 322 fetuses or 70 % were conceived in the period between June 2nd and October 28th, a period of about 4—5 months corresponding to the winter and earliest Spring months of the Southern hemisphere.

The calculation thus clearly indicates a "pairing season", the season in which the majority of pairings take place. In the case of the fin whales it extends farther towards the Spring than is the case with the blue whale.

I have no doubt that this has a certain connection with the fact that the fin whale, apart from certain animals, appears considerably later in the Southern Fields than is the case with the blue whale.

At the South African Stations we can also as a rule notice that the fin whale remains in the field longer towards the Spring than does the blue whale. This however is by no means as marked as is the case with the migration of the two species of whales to the Southern Whaling Field.

In the case of the fin whale foetuses, too, I will give a special calculation of the foetuses measured at the shore station of South Georgia, since as I have mentioned I consider these measurements to be particularly valuable.

Figure 28 (p. 78) gives a graphic representation of these measurements on the basis of the same method of calculation as that which I have already described. In Table 41 there will be found figures upon which the graphic representation is based.

The calculation gives the following result:

Table 41.

Month	Average plus σ	Calculated pairing day	Average minus σ	Calculated pairing day	Total foetuses	Total measurements between av. plus σ and av. minus σ given in %
October.....	1110 mm.	$^{16}/_{6}$	340 mm.	$^{23}/_{7}$	14	71 %
November.....	1930 —	$^{10}/_{6}$	960 —	$^{23}/_{7}$	48	58 -
December.....	2520 —	$^{14}/_{6}$	1140 —	$^{14}/_{8}$	44	64 -
January	3380 —	$^{7}/_{6}$	1560 —	$^{27}/_{8}$	36	69 -
February	4110 —	$^{6}/_{6}$	1510 —	$^{29}/_{9}$	24	71 -
March	5170 —	$^{18}/_{5}$	3020 —	$^{21}/_{8}$	14	71 -
April	6000 —	$^{12}/_{5}$	3560 —	$^{28}/_{8}$	18	61 -
May.....	5970 —	$^{12}/_{6}$	3280 —	$^{10}/_{10}$	11	55 -

Of the 209 fin whale foetuses measured at South Georgia 135 or 65 % were conceived during the period May 12th and October 10th, i. e. nearly five months, corresponding to the winter and early summer of the Southern hemisphere.

By perusing this table it will further be found that there is a very marked concentration of pairings from the middle of June till about August 20th.

I therefore consider that as regards fin whale foetuses the material here produced and calculated confirms what I have already stated in the case of the blue whale:

1) The fin whale may pair at practically speaking all times of the year.
2) The vast majority of pairings take place, however, in the months of June, July, August and September.
3) Pairings of fin whales may also take place during the time when the animals usually stay in the Antarctic Whaling Fields. The vast majority of pairings take place, however, at times when the fin whale stays in more temperate waters, outside the present whaling fields of the Southern Seas.

Twin Foetuses.

It has long been known that all the large species of whale may sometimes have more than one foetus. The material here submitted for blue whales and fin whales also contains a number of instances of this. I will, therefore, as a conclusion to my account of occurrences of foetuses collect those cases of twins which are noted in the material dealt with.

In the material concerning blue whale foetuses there are found the following occurrences of twins.

$^{13}/_{1}$ 1922: 91 feet mother with two foetuses, length 9 feet and 8 feet
$^{28}/_{11}$ 1924: 80 — — — — — — 7 — — 6 —
$^{12}/_{12}$ 1924: 82 — — — — — — 8 — — 4 —
$^{21}/_{1}$ 1925: 71 — — — — — — $9^{1}/_{2}$ — — 8 —

Thus in 593 measurements of foetuses there are only noted 4 cases of twins given a frequency of about 0.7 %. As a rule the foetuses vary somewhat in length which would appear to be quite natural. The case of twins of December 12th 1924 in which one foetus was 8 feet and the other only 4 feet is, however, so divergent that it forms a class by itself. I am aware, however, that the case is not unique but it is outside the scope of this work to attempt any explanation of the matter.

In the material concerning fin whale foetuses there occur the following cases of twins:

$^{24}/_{11}$ 1923: 69 feet mother with two foetuses, length $3^1/_2$ feet and $3^1/_2$ feet
$^{27}/_{11}$ 1924: 73 — — — — — — $7^1/_4$ — — $6^2/_3$ —
$^{19}/_1$ 1925: 78 — — — — — — 7 — — 8 —

In a total of 462 measurements of foetuses there were thus noted only 3 cases of twin births. This gives a frequency of about 0,7 %, the same percentage as that in the case of the blue whale.

As a unique occurrence it may be reported that at the whaling station in Prince Olav's Harbour, South Georgia of "The Southern Whaling & Sealing Company", during the season 1924—1925 there was caught a blue whale which had 7 (seven) foetuses. The foetuses had the following length, weight and sex:

1.	Length	$52^1/_2$	Eng.	inch,	weight	21.7	kilos	female.
2.	—	39	—	—	—	10.0	—	male.
3.	—	54	—	—	—	23.0	—	female.
4.	—	53	—	—	—	21.7	—	male.
5.	—	43	—	—	—	13.2	—	male.
6.	—	51	—	—	—	20.4	—	male.
7.	—	51	—	—	—	18.2	—	female.

The foetuses were carefully measured and weighed by the manager of the station, Einar Abrahamsen of Sandefjord. The rare discovery was photographed and was published by me in the "Norsk Hvalfangsttidende" October 1925.

Foetus measurements from the Northern Seas.

In recent years the Norwegian Whalers Association have collected statistics of measurements from all the fields in the Northern Seas. In Section 4 of the present work I have already briefly discussed the result of these measurements in so far as concerns the size of the captured animals.

In Section 5 I have also discussed the average produce of oil from the various species of whale in the different fields of the Northern Seas. There now remains to discuss the measurements of foetuses from the various fields of the Northern Seas.

We here at once meet with the difficulty that the material at our disposal is far too scanty. Although the capture of animals belonging to the fin whale group

Table 42. Fin Whale Foetuses.

Measured on different stations in the Norwegian Sea.

Date	Length		cm.	Where measured	Date	Length		cm.	Where measured
	Mother feet	Foetus feet				Mother feet	Foetus feet		
13/2 1926	60′	1′ 4″	42	The coast off Möre	19/5 1888	?	4′	126	Finmark
20/2 1923	72′	12′ 0″	377	—	20/5 1886	?	4′	126	—
21/2 1926	70′	0′10″	26	—	— 1890	?	4′ 8″	147	—
25/2 1925	63′	0′ 3″	8	—	21/5 1886	?	5′ 1″	160	—
— —	70′	2′ 6″	79	—	— 1909	64′	2′ 4″	73	Shetland
12/3 1923	68′	0′ 9″	24	—	— 1920	65′	1′ 2″	37	—
14/3 —	75′	1′ 0″	31	—	22/5 1888	66′	5′ 0″	157	Finmark
18/3 —	69′	1′ 4″	42	—	23/5 1889	?	1′ 7″	50	—
20/3 —	69′	0′ 5″	13	—	25/5 1926	70′	0′ 4″	10	The coast off Möre
30/3 1885	?	0′ 5″	13	Finmark	26/5 1883	?	3′ 0″	94	Finmark
— 1897	?	0′ 3″	8	—	27/5 1894	63′	4′ 0″	126	—
1/4 1894	60′	2′ 0″	63	—	28/5 1883	?	1′ 0″	31	—
8/4 1897	66′	2′ 6″	79	—	— 1886	?	3′ 0″	94	—
9/4 1896	66′	1′ 6″	47	—	1/6 1908	66′	4′ 6″	141	Shetland
11/4 1892	64′	2′ 0″	63	—	— 1925	66′	0′ 6″	16	The coast off Möre
12/4 1885	?	8′ 0″	251	—	2/6 1888	?	4′ 5″	139	Finmark
14/4 —	?	1′ 2″	37	—	3/6 1885	?	3′ 8″	115	—
— 1896	65′	3′ 0″	94	—	4/6 1886	?	3′ 3″	102	—
— —	65′	2′ 0″	63	—	— 1925	61′	3′ 0″	94	The coast off Möre
— 1908	64′	1′ 4″	42	Shetland	— —	66′	2′ 6″	79	—
16/4 1887	?	2′ 3″	71	Finmark	6/6 —	67′	2′ 0″	63	—
20/4 1925	67′	2′ 0″	63	Hordaland	8/6 —	65′	2′ 6″	79	The Faroes
24/4 1885	?	2′ 6″	79	Finmark	9/6 1886	?	5′ 0″	157	Finmark
25/4 1891	63′	2′ 0″	63	—	— 1925	64′	4′ 0″	126	The Faroes
27/4 1908	73′	3′ 0″	94	Shetland	— —	67′	3′ 0″	94	—
28/4 1885	?	2′ 6″	79	Finmark	— —	71′	3′ 5″	107	The coast off Möre
28/4 1925	69′	2′ 0″	63	Hordaland	10/6 1886	?	8′	251	Finmark
29/4 1885	?	3′ 3″	102	Murmann	— 1925	68′	3′ 0″	94	The coast off Möre
30/4 1894	60′	0′11″	29	Finmark	11/6 1883	?	4′ 6″	141	Finmark
— 1908	64′	2′ 0″	63	Shetland	— 1925	73′	4′ 9″	149	The coast off Möre
2/5 1885	?	3′ 0″	94	Finmark	— —	68′	6′ 0″	188	The Faroes
— 1886	?	4′ 5″	139	—	12/6 1893	?	3′ 6″	110	Finmark
2/5 1887	?	2′11″	92	—	13/6 1913	?	0′ 5″	13	The West coast of Ireland
3/5 1885	?	1′ 2″	37	—					
— 1887	?	2′ 4″	73	—	— 1924	60′	4′ 0″	126	The Faroes
7/5 1885	?	4′	126	—	15/6 1893	66′	7′ 0″	220	Finmark
8/5 1889	64′	2′ 5″	76	—	— 1925	59′	1′ 6″	47	Kamtchatka
— 1892	62′	4′ 2″	131	—	16/6 1896	62′	7′ 0″	220	Finmark
9/5 1909	69′	3′ 6″	110	Shetland	17/6 1926	65′	3′ 6″	110	The coast off Möre
17/5 1882	?	1′ 5″	45	Finmark	18/6 1886	?	2′	63	Finmark
— —	?	3′ 1″	97	—	19/6 1926	68′	0′ 3″	8	The coast off Möre

Date	Length		cm.	Where measured
	Mother feet	Foetus feet		
20/6 1886	?	3′	94	Finmark
21/6 1925	65′	7′ 0″	220	The Faroes
23/6 —	70′	8′ 0″	251	—
		8′ 0″	251	
— —	67′	2′ 0″	63	—
— —	65′	5′ 0″	157	The coast off Möre
24/6 1886	?	4′	126	Finmark
— 1924	63′	5′ 0″	157	The Faroes
— 1925	70′	7′ 0″	220	—
25/6 1884	?	4′ 4″	136	Murmann
— 1925	68′	7′ 0″	220	The coast off Möre
26/6 1924	62′	5′ 0″	157	The Faroes
— 1925	64′	4′ 2″	131	The coast off Möre
28/6 —	70′	3′ 6″	110	The Faroes
— —	59′	3′ 0″	94	—
— —	75′	6′ 0″	188	The coast off Möre
29/6 1886	?	8′ 0″	251	Finmark
— 1903	?	3′ 0″	94	—
30/6 1883	?	6′ 6″	204	—
— 1924	70′	7′ 0″	220	The Faroes
— 1925	67′	0′ 8″	21	The coast off Möre
1/7 1886	?	5′ 5″	170	Finmark
— 1925	62′	6′ 0″	188	The Faroes
— —	64′	2′ 0″	63	—
— —	66′	7′ 6″	236	The coast off Möre
— —	68′	1′ 3″	39	—
2/7 1885	?	12′ 0″	377	Finmark
— 1886	67′	7′ 6″	236	—
— 1925	64′	3′ 2″	99	The coast off Möre
3/7 —	64′	5′ 0″	157	—
— —	60′	3′ 4″	105	—
4/7 1924	70′	6′ 0″	188	The Faroes
— 1925	72′	7′ 0″	220	The coast off Möre
5/7 1886	?	5′ 6″	173	Finmark
— —	?	6′ 0″	188	—
— 1889	?	4′ 0″	126	—
— 1908	66′	2′ 6″	79	Shetland
— 1922	72′	1′ 9″	55	The West coast of Ireland
— 1925	67′	4′ 0″	126	Hordaland
6/7 1887	?	1′ 8″	52	Finmark
— 1923	69′	6′ 0″	188	The coast off Möre
7/7 1886	?	6′ 6″	204	Finmark
7/7 1886	?	8′ 1″	254	Finmark
— 1925	62′	2′ 0″	63	The Faroes
— 1926	65′	5′ 0″	157	The coast off Möre
8/7 1886	?	6′ 0″	188	Finmark
— 1890	?	19′ 9″	620	—
— 1922	62′	3′ 0″	94	The West coast of Ireland
— 1925	70′	2′ 0″	63	The Faroes
— —	68′	5′ 0″	157	The coast off Möre
— —	67′	3′ 0″	94	—
9/7 1886	?	6′ 6″	204	The Faroes
— 1891	66′	2′ 3″	71	Finmark
— 1903	?	6′ 0″	188	—
— —	?	4′ 0″	126	—
— 1924	67′	8′ 0″	252	The Faroes
10/7 1884	?	5′ 5″	170	Finmark
— 1896	?	4′ 8″	147	—
— 1909	?	1′ 5″	44	6 Foetuses in a whale
		1′ 6″	47	
		1′ 8″	52	The East coast of Iceland
		2′10″	89	
		2′10″	89	
		2′10″	89	
10/7 1925	65′	6′ 0″	188	The coast off Möre
11/7 1882	?	7′ 6″	236	Finmark
— 1886	?	6′ 0″	188	—
12/7 1886	?	1′ 5″	44	—
— 1911	?	8′ 8″	272	The West coast of Ireland
— 1925	71′	15′ 6″	487	The coast off Möre
13/7 —	69′	4′ 6″	141	—
		4′ 6″	141	
14/7 —	69′	4′ 0″	126	—
15/7 1923	?	14′ 6″	455	The West coast of Ireland
— 1925	70′	1′ 0″	31	The coast off Möre
16/7 1888	?	8′ 1″	254	Finmark
— 1911	?	4′ 9″	149	The West coast of Ireland
— 1926	68′	5′ 6″	173	The coast off Möre
17/7 1896	?	6′ 6″	204	Finmark
— 1925	65′	9′ 0″	283	The Faroes
20/7 1888	?	3′ 0″	94	Finmark

Date	Length		cm.	Where measured
	Mother feet	Foetus feet		
20/7 1911	?	8′ 2″	256	The West coast of Ireland
— 1926	67′	5′ 0″	157	The coast off Möre
22/7 1925	66′	8′ 6″	267	—
23/7 —	70′	8′ 0″	251	The Faroes
24/7 1882	?	8′ 3″	259	Finmark
— 1886	?	7′ 0″	220	—
— —	?	9′10″	309	—
— 1911	?	5′10″	183	The West coast of Ireland
— 1922	68′	3′ 1″	97	—
— 1925	73′	6′ 0″	189	The Faroes
— —	64′	8′ 6″	267	The coast off Möre
25/7 1892	70′	9′ 0″	283	Finmark
26/7 1886	?	7′ 0″	220	—
27/7 1925	71′	0′ 8″	21	The coast off Möre
28/7 1888	?	4′ 6″	141	Finmark
29/7 1908	64′	10′ 0″	314	Shetland
— 1925	63′	6′ 0″	188	The Faroes
		6′ 0″	188	
30/7 —	61′	8′ 0″	251	—
31/7 1893	?	3′ 0″	94	Finmark
— 1909	?	1′ 0″	31	The West coast of Ireland
— —	?	5′ 4″	168	—
— 1925	55′	12′ 0″	377	Kamtchatka
1/8 1893	?	2′ 0″	63	Finmark
2/8 —	?	2′ 0″	63	—
3/8 1899	?	7′ 8″	241	New-Foundland
— —	?	8′ 9″	275	—
— 1924	62′	4′ 0″	126	The Faroes
— 1925	64′	9′ 0″	283	—
— 1926	73′	7′ 8″	241	The coast off Möre
4/8 1888	?	5′ 4″	168	Finmark
— 1899	?	6′ 8″	209	New-Foundland
— 1925	63′	5′ 0″	157	The coast off Möre
5/8 1892	68′	7′ 0″	220	Finmark
— 1899	?	6′ 3″	196	New-Foundland
6/8 1889	68′	11′ 6″	361	Finmark
7/8 1892	64′	7′ 0″	220	—
— 1908	64′	4′ 6″	141	Shetland
— 1911	?	5′ 4″	168	The West coast of Ireland

Date	Length		cm.	Where measured
	Mother feet	Foetus feet		
7/8 1913	?	3′10″	121	The West coast of Ireland
— —	?	7′ 7″	238	—
8/8 1889	?	10′	314	Finmark
— 1899	?	12′ 5″	390	New-Foundland
— 1924	62′	8′ 0″	251	The Faroes
— 1925	71′	12′ 0″	377	Hordaland
9/8 1896	?	6′ 4″	199	Finmark
		8′ 3″	259	
11/8 1892	68′	8′ 0″	251	—
— 1911	?	8′ 9″	275	The West coast of Ireland
— 1925	70′	12′ 0″	377	Hordaland
14/8 1896	?	5′ 6″	173	Finmark
— —	70′	5′ 6″	173	—
15/8 1899	?	14′ 8″	461	New-Foundland
— —	?	12′ 4″	387	—
18/8 —	?	11′ 0″	345	—
— —	?	6′ 7″	207	—
20/8 1888	?	5′ 7″	175	Finmark
— 1924	58′	8′ 0″	251	The Faroes
22/8 1899	?	6′ 8″	209	New-Foundland
23/8 1925	73′	1′ 0″	31	Hordaland
27/8 1913	?	7′ 7″	238	The West coast of Ireland
4/9 1913	?	3′10″	120	—
8/9 1922	60′	12′ 0″	377	—
— 1925	61′	3′ 0″	94	Kamtchatka
9/9 1913	?	9′ 1″	285	The West coast of Ireland
— 1925	66′	14′ 0″	440	Hordaland
10/9 1911	?	8′ 9″	275	The West coast of Ireland
12/9 1925	68′	15′ 0″	471	Hordaland
15/9 1920	67′	14′ 0″	440	Shetland
17/9 —	65′	11′ 0″	345	—
— 1925	66′	14′ 0″	440	Hordaland
18/9 1911	?	9′	283	The West coast of Ireland
19/9 1925	63′	18′ 0″	565	Kamtchatka
26/9 1922	66′	8′ 0″	251	The West coast of Ireland
28/9 1925	73′	15′ 0″	471	Hordaland

Date	Length		cm.	Where measured	Date	Length		cm.	Where measured
	Mother feet	Foetus feet				Mother feet	Foetus feet		
$^{30}/_{9}$ 1925	71′	15′ 0″	471	Hordaland	$^{2}/_{12}$ 1899	?	18′ 2″	570	Newly born, stranded on Jaederen — Collett —
$^{17}/_{10}$ —	69′	14′ 0″	440	—					
$^{27}/_{11}$ 1891	?	16′ 3″	510	Oslofjord					
— —	?	8′11″	280	—					

has been carried on in the Northern Seas for about 60 years, in comparison with the Southern Seas there are only a few measurements from the Northern Fields. The old whalers in general did not take the trouble to measure whales and whale fetuses, and when our men of science in this domain endeavoured to collect data and information little was obtainable.

Foetus measurements of blue whales and humpbacks are therefore found only in small numbers. There was no systematic collection of that kind of material and the whole has the character of mere chance observation.

The state of affairs with regard to the fin whale is somewhat better. In this case I have succeeded in collecting 242 measurements of foetuses, since in addition to the material which I myself have collected I have included the statistics from Martin A. C. Hinton's previously mentioned work, which to some degree I myself had not previously noted. The material concerning fin whale foetuses has therefore acquired such a size that it appears that it could be used without our running a risk of meeting too many chance cases.

In the case of the sei whale, too, I have collected material. It comprises 95 measurements and is thus not large. It would appear, however, that these measurements of the pairing time of the sei whale are more definite than is the case with the blue whale and fin whale.

In Table 42, I have given the measurements of fin whale foetuses, and in a special column I have stated the field where the foetus was measured.

As regards the measurements themselves, these were partly made originally in Norwegian inches and partly in English inches. In the present work I have converted the measurements to Norwegian inches and later these have again been converted into centimetres. In this way the measurements are not absolutely exact but the difference in each case is so insignificant that it plays no part whatever in the calculation. Moreover, it is evident that the conditions under which the foetuses are measured at the stations make no definite demand for absolute exactitude in the record of measurements.

If we calculate the length of the foetuses in the various months we obtain the following average measurement:

February	5	foetuses,	average size	106 cm.
March	6	—	—	22 —
April	19	—	—	76 —
May	24	—	—	94 —
June	48	—	—	134 —
July	83	—	—	177 —
August	38	—	—	232 —
September	15	—	—	355 —
October	1	—	—	440 —
November	2	—	—	395 —
December	1	—	—	570 —

Total... 242 foetuses.

It appears from this that the foetuses increase regularly in size during the months of the year. An exception is found in February—March, the average being considerably higher for February than for March. If, however, we go back to the original measurements, it will be found that there is one measurement of a foetus from February 20th 1923 which raises the average. The high average for that month thus depends upon a pure coincidence. It is due to one of these occurrences which shew that the fin whale may pair at all times of the year, and with which we are already acquainted from our discussion of the occurrence of fetuses in the waters of the Southern hemisphere.

The average calculation further shews a diminution in the size of the foetus in November as compared with October. This, however, is also not to be relied upon as the number of measurements is only two. One of the measured foetuses from the month of November, however, had a size of 510 cm. which would normally be expected at that time of the year.

In the case of these measurements of foetuses I have also caused Director Fr. Lange-Nielsen to estimate the standard average in accordance with the method I have already explained when discussing the occurrences of fetuses in the Southern Seas.

As a result of his calculations we have a graphic representation (fig. 29, p. 108), and also a table (Table 43) which shews the standard average (σ), the coefficient of variation (V), and also the largest and smallest measurements of the foetuses measured in month. Finally, the table gives the number of measurements situated between the average length plus σ and the average length minus σ, stated as percentages of the total number of measurements in each month.

I will now proceed to estimate the "pairing day" of these fin whale foetuses from the Northern Seas.

The smallest foetuses in the material submitted are the following:

Foetus measured	$^{30}/_{3}$	1897	(Finmark)	length	3	inches	= 8 cm.
— —	$^{25}/_{2}$	1925	(Möre coast)	—	3	—	= 8 —
— —	$^{19}/_{6}$	1926	(Möre coast)	—	3	—	= 8 —

The largest foetuses in the material submitted are the following:

Foetus measured $^{8}/_{7}$ 1890 (Finmarken) length 19 feet 9 inches = 620 cm.
— — $^{19}/_{9}$ 1925 (Kamtchatka) — 18 — 0 — = 565 cm.

I assume in my calculations that the period of gestation for the Northern fin whales is the same as that of the Southern fin whales, namely 360 days.

On the other hand I am inclined to believe that the fully grown foetus of the Northern Seas is not as large as that in the Southern Seas. In the chapter on the size of the whale I have already had an opportunity of proving that the species of the Northern Seas (the blue whale and fin whale) never reached the size of the corresponding species of whales in the Southern Seas. I shall later on in this work have an opportunity of shewing that gestation has been found to have begun in a fin whale of the Northern Seas whilst the whale was smaller than is the case when gestation commenced in the Southern Seas. I therefore consider that it is correct to reckon with a smaller newly born fin whale in the Northern Seas.

Whilst, therefore, in my calculations of the fin whale foetuses in the Southern Seas I assumed a length of 6500 mm. in the newly born young ones, in calculating the foetuses from the Northern Seas I have assumed a length of 6000 mm. These figures have not been settled by chance.

As will appear from what I have written before the average size of the fin whale from the whaling fields in the Southern Seas is about 66 feet. In the Northern Seas the average size is about 60 feet. A corresponding difference in the size of Northern and Southern fin whales can also be shewn by means of the figures which give the lowest sizes noted of gestating females from the Southern and Northern Seas. Finally, in the whole of the material from the Northern Seas there is only

Table 43.

Measurements of whale foetuses. Fin whale.

Measured in the Norwegian Sea.

Month	Number	Average length L	Standard deviation σ	Coefficient of variation V	Maximum length	Minimum length	Number of measurements between $L+\sigma$ and $L-\sigma$ in %
February ..	5	106 cm.	137 cm.	129.25 %	377 cm.	8 cm.	80 %
March	6	22 -	12 -	54.55 -	42 -	8 -	67 -
April	19	76 -	45 -	59.21 -	251 -	29 -	89 -
May.....	24	94 -	42 -	44.68 -	160 -	10 -	58 -
June	48	134 -	66 -	49.25 -	251 -	8 -	60 -
July.....	83	177 -	106 -	59.89 -	620 -	21 -	76 -
August	38	232 -	95 -	40.95 -	461 -	31 -	68 -
September .	15	355 -	131 -	36.90 -	565 -	94 -	80 -
October....	1	440 -					
November..	2	395 -					
December..	1	570 -					

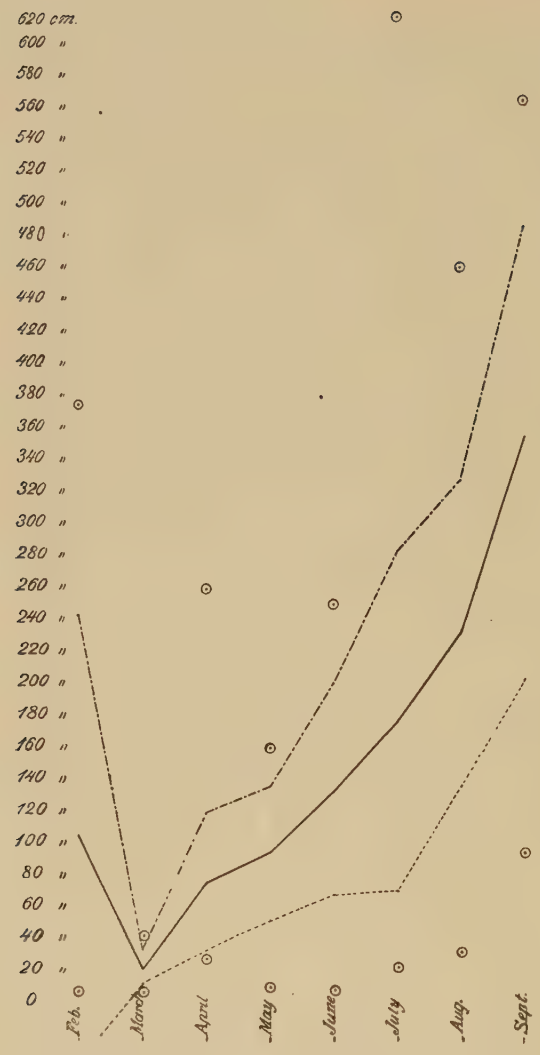

Figure 29. Fin whale foetuses in the Norwegian Sea.
—·—·—·— Average length + σ.
———— — — —
- - - - - - - — — — σ.
⊙ Maximum and minimum length.

one measurement of a foetus of 6000 mm. and upwards, whilst in the corresponding material from the Southern Seas there are 6 measurements which shew 6000 mm. or more (6280 mm.—6594 mm.). In addition as I have already mentioned I have one foetus measurement of a fin whale from the Southern Seas of 6908 mm. This measurement belongs to the figures from 1925—1926 which moreover also contain 2 measurements of fin whale foetuses 6280 mm. in length. Whilst fin whale foetuses of over 6000 mm. are not very rare amongst the Southern fin whales only one single case (6200 mm.) is known from the Northern Seas.

It therefore appears natural that the estimated size of the newly born fin whales of the Northern Seas is placed at 6000 mm. This figure may possibly be too high.

The time estimated for the attainment of 100 mm. in length is estimated at 60 days. The time estimated for the attainment of another 300 mm. in length = 30 days. It is thus estimated that the foetus reaches a length of 400 mm. after the course of 90 days.

Again, 6000 mm. minus 400 = 5600 mm., which is the growth during the 270 days then remaining of the period of gestation.

The age of the foetus should thus be 90 days plus $^{5600}/_{270}$. If we then employ these figures in calculating the time of the 242 pairings from the Northern Seas, we come to the following results regarding the "day of pairing", and I assume that the following table will be understood from previous explanations when discussing the measurements of foetuses in the Southern Seas.

In giving the above graphic representation (figure 29) and the table belonging to the same (Table 43) I would point out that I have not included in the calculation the five foetuses measured in February, as the average of these few measurements is so strongly affected by the coincidence I have already mentioned (Page 106). Neither have I included measurements from October (one measurement) November (two measurements) and December (one measurement). We then have the following calculation:

Table 44.

Month	Average plus σ	Calculated pairing day	Average minus σ	Calculated pairing day	Total foetuses	Total measurements between av. plus σ and av. minus σ given in %
March	340 mm.	$^{21}/_{12}$	100 mm.	$^{14}/_{1}$	6	67 %
April	1210 —	$^{7}/_{12}$	310 —	$^{24}/_{1}$	19	89 -
May.....	1360 —	$^{30}/_{12}$	520 —	$^{8}/_{2}$	24	58 -
June	2000 —	$^{30}/_{12}$	680 —	$^{3}/_{3}$	48	60 -
July.....	2830 —	$^{20}/_{12}$	700 —	$^{2}/_{4}$	83	76 -
August	3270 —	$^{30}/_{12}$	1370 —	$^{31}/_{3}$	38	68 -
September	4860 —	$^{14}/_{11}$	2240 —	$^{20}/_{3}$	15	80 -

Of the 242 fin whale foetuses measured in the Norwegian Sea 165 foetuses or at least 68 % were thus conceived during the period November 14th—April 2nd, a period of at least $4^{1}/_{2}$ months corresponding to the winter months in the Northern hemisphere. If we examine the table more closely we find that the greatest concentration of pairings takes place about December 20th until about the middle of March.

If we compare this with the calculations from the Southern Seas it will be found that the bulk of pairings both in the North and South take place in the corresponding winter months of the two hemispheres.

As will be seen the result is the same as that found by Martin Hinton by his calculations.

Sei Whale.

As already mentioned my material of sei whale measurements comprises the length of 95 foetuses. The majority of these sei whale foetuses were measured on the Möre coast of West Norway where this species of whale in recent years has been commercially exploited on a considerable scale. However, it only stays a short time on this stretch of coast and its appearance in the Northern Seas is, on the whole, entirely restricted to the Spring and summer months. There is also in the material a collection of measurements from earlier years from Shetland and Finmarken, but these are quite few in number.

I append a list of the sei whale foetuses measured:

Table 45. Sei Whale Foetuses.

Measured on different stations in the Norwegian Sea.

Date	Length		cm.	Where measured	Date	Length		cm.	Where measured
	Mother feet	Foetus feet				Mother feet	Foetus feet		
9/4 1926	46′	2′ 0″	63	The coast off Möre	22/5 1925	46′	1′ 6″	47	The coast of Möre
14/4 1923	48′	2′ 0″	63	—	24/5 1926	48′	1′ 3″	39	—
19/4 1926	47′	2′ 4″	73	—	28/5 1925	46′	3′ 0″	94	—
20/4 1923	47′	0′ 9″	24	—	— —	39′	2′ 6″	79	—
— 1926	47′	2′ 4″	73	—	— 1920	50′	4′ 0″	126	Shetland
22/4 —	46′	2′ 2″	68	—	— —	50′	2′ 0″	63	—
24/4 1923	47′	0′ 9″	24	—	29/5 1925	45′	4′ 6″	141	The coast off Möre
25/4 1926	46′	0′ 6″	16	—	— —	46′	4′ 6″	141	—
26/4 1925	41′	4′ 6″	141	—	30/5 1923	45′	2′ 3″	71	—
— —	42′	4′ 0″	126	—	31/5 —	46′	2′ 8″	84	—
28/4 —	46′	1′ 6″	47	—	— —	45′	3′ 2″	99	—
— —	43′	3′ 0″	94	—	3/6 —	47′	3′10″	120	—
— —	45′	3′ 0″	94	—	— 1925	42′	4′ 0″	126	—
— 1926	46′	2′ 6″	79	—	— —	44′	3′ 5″	107	—
30/4 1923	46′	1′ 2″	37	—	11/6 1920	50′	4′ 0″	126	Shetland
— 1926	45′	1′ 8″	52	—	— —	49′	6′ 0″	188	—
— —	47′	0′ 4″	10	—	— —	50′	7′ 0″	220	—
2/5 1923	48′	1′ 6″	47	—	— 1923	46′	3′ 4″	105	The coast off Möre
— 1925	40′	4′ 0″	126	—	— —	45′	3′ 0″	94	—
		3′ 6″	110		12/6 1926	42′	2′ 3″	71	—
4/5 1923	48′	3′ 0″	94	—	15/6 1920	53′	6′ 0″	188	Shetland
— —	48′	2′ 6″	79	—	— 1923	46′	3′ 2″	99	The coast off Möre
— 1925	46′	3′ 0″	94	—	17/6 1920	48′	3′ 0″	94	Shetland
— —	45′	3′ 6″	110	—	19/6 1923	46′	3′ 5″	107	The coast off Möre
— 1926	45′	2′ 0″	63	—	— —	46′	3′ 8″	115	—
— —	42′	2′ 6″	79	—	21/6 1920	48′	6′ 0″	188	—
5/5 1925	47′	3′ 0″	94	—	— 1923	46′	6′ 0″	188	Shetland
— —	46′	3′ 0″	94	—	— 1925	44′	4′ 4″	136	The coast off Möre
7/5 —	46′	1′ 6″	47	—	22/6 —	46′	2′ 4″	73	—
8/5 1926	47′	0′ 3″	8	—	26/6 1920	50′	5′ 0″	157	Shetland
9/5 1925	46′	4′ 6″	141	—	29/6 1923	46′	5′ 8″	178	The coast off Möre
— —	46′	4′ 0″	126	—	— 1925	46′	6′ 0″	188	—
10/5 —	40′	4′ 6″	141	—	— 1926	46′	4′ 6″	141	—
— —	48′	6′ 0″	188	—			4′ 6″	141	
16/5 —	47′	2′ 0″	63	—	30/6 1923	46′	6′ 7″	207	—
17/5 —	41′	2′ 6″	79	—	1/7 1920	48′	5′ 6″	173	Shetland
18/5 1926	45′	1′ 9″	55	—	— 1923	47′	6′ 3″	196	The coast off Möre
— 1909	45′	3′ 0″	94	Shetland	— 1925	46′	3′ 0″	94	—
22/5 1923	45′	2′ 9″	86	The coast off Möre	2/7 1885	?	6′ 0″	188	Finmark
— 1925	45′	2′ 0″	63	—	— 1903	?	6′ 0″	188	—
— —	47′	1′10″	58	—	— 1923	47′	7′ 0″	220	The coast off Möre

Date	Length		cm.	Where measured	Date	Length		cm.	Where measured
	Mother feet	Foetus feet				Mother feet	Foetus feet		
5/7 1903	46′	7′ 3″	228	The coast of Möre	10/8 1885	50′	8′ 6″	267	Finmark
7/7 —	48′	8′ 2″	256	—	11/8 1892	42′	10′ 0″	314	—
8/7 —	45′	6′ 4″	199	—	12/8 1896	52′	4′ 0″	126	—
— —	46′	7′ 8″	241	—	16/8 1920	48′	9′ 0″	283	Shetland
10/7 1925	50′	5′ 3″	165	—	20/8 1897	44′	3′ 0″	94	Finmark
18/7 1923	46′	9′ 0″	283	—	21/8 —	40′	9′ 8″	304	—
24/7 —	49′	10′ 0″	314	—					

If we compare the length of the foetuses in the various months we have the following average measurements:

In April	17	foetuses,	average length	64 cm.
- May	35	—	—	89 —
- June	24	—	—	140 —
- July	13	—	—	211 —
- August	6	—	—	231 —
Total...	95	sei whale foetuses.		

It appears from this that the foetuses regularly increase in length during the summer. None of the curves shewing the average size of measured foetuses given in the present work exhibit more even conditions than this curve for sei whale foetuses. It must therefore be assumed that this species of whale has a more markedly restricted pairing time than both the blue and the fin whale.

The largest foetuses in the material here submitted have a length of 10 feet equals 314 cm. One foetus was measured on the Möre coast on July 24th 1923 and one measured on the coast of Finmarken on August 11th 1922. None of these foetuses however were nearly fully grown and we must therefore reckon with a considerably larger average length in the fully grown foetuses.

I have however from South Georgia a number of measurements of sei whale foetuses, e. g. three 14 feet in length (440 cm.) and one 15 feet in length (471 cm.). All these measurements are from April 1924. The last, however, was from May of the same year. I have been informed that these foetuses "appear to approach the stage of full growth". On account of lack of material it is of course not possible to say what length the fully grown sei whale foetus has on an average, but I do not think we are far wrong in estimating it at 15 feet equals 4800 mm. I have therefore in the following calculation of sei whale foetuses made the following assumption:

The length of the fully grown foetus is assumed to be 4800 mm.
The period of gestation is also here assumed to be 360 days.
In order to attain a length of 100 mm. there are estimated 60 days.
In order to attain the next 200 mm. there are estimated 30 days.
Of the foetus period 360 days minus (60 plus 30) equals 270 days.
The foetus must thus in these 270 days be estimated at increasing in length 4800 mm. minus (100 plus 200) equals 4500 mm.
The age of the foetus should thus be 90 days plus $^{4500}/_{270}$.

Table 46.

Measurements of whale foetuses. Sei whale. Calculated for February 1927.

Measured in the Norwegian Sea.

Month	Number	Average length L	Standard deviation σ	Coefficient of variation V	Maximum length	Minimum length	Number of measurements between $L+\sigma$ and $L-\sigma$ in %
April	17	64 cm.	36 cm.	56.25 %	141 cm.	10 cm.	65 %
May	35	89 -	36 -	40.45 -	188 -	8 -	63 -
June	24	140 -	43 -	30.71 -	220 -	71 -	54 -
July	13	211 -	54 -	25.59 -	314 -	94 -	77 -
August	6	231 -	88 -	38.10 -	314 -	94 -	67 -

The accompanying curve (figure 30) and table 46 form the basis of the calculations in the same manner as those I have previously described.

The calculations give the following result:

Table 47.

Month	Average plus σ	Calculated pairing day	Average minus σ	Calculated pairing day	Total foetuses	Total measurements between av. plus σ and av. minus σ given in %
April	1000 mm.	$^{4}/_{12}$	280 mm.	$^{18}/_{1}$	11	65 %
May	1250 —	$^{19}/_{12}$	330 —	$^{12}/_{2}$	22	63 -
June	1830 —	$^{15}/_{12}$	970 —	$^{5}/_{2}$	13	54 -
July	2650 —	$^{26}/_{11}$	1570 —	$^{30}/_{1}$	10	77 -
August	3190 —	$^{25}/_{11}$	1430 —	$^{10}/_{3}$	4	67 -

Of the 95 sei whale foetuses, 60 foetuses or about 63 % were thus conceived during the period November 25th—March 10th i. e. about $3^{1}/_{2}$ months.

If we disregard the 6 measurements from the month of August we find that of all the sei whale foetuses measured in the Northern Seas, about 55 % were conceived in the period between November 26th and February 12th, a period of about $2^{1}/_{2}$ months, corresponding to mid-winter in the Northern hemisphere.

Cases of Multiple Foetuses.

There are a number of records also from the whaling fields of the Northern Seas concerning whales which have had more than one foetus.

Fin whales.

9th August 1896: fin whale with 2 foetuses, length 2600 and 2000 mm.
23th June 1925: — — 2 — 2510 mm. and 2510 mm. in length
13th July 1925: — — 2 — 1410 — — 1410 — —
29th July 1925: — — 2 — 1880 — — 1880 — —
Besides some doubtful cases.

As an absolute rarety it may be mentioned that on July 10th 1909 at the whaling station in Hellis Fjord, Iceland, there was caught a female fin whale with 6 foetuses. The case has been described and certified by several of the crew present so that there can be no doubt whatever of its accuracy. The foetuses were carefully measured and examined. The foreman of the Station stated the measurements to me personally. Three of the foetuses had a length of 34 inches each, one was 20, one was 18 and one foetus was 17 inches in length.

At the station Getares in South Spain there was also captured a female fin whale with 6 foetuses. The case was reported to me by the manager of the whaling company concerned. A photograph was taken of the rare discovery and I myself have seen it. I have not obtained the measurements of the foetuses.

There was also at one of the whaling stations in the Faroes a number of years ago captured a female fin whale with three foetuses. The case was reported to me by the manager of the whaling company, but I am unable to give details, nor have I seen any photograph of the foetuses. There is, however, no reason to doubt the accuracy of the report.

Figure 30. Sei whale foetuses in the Norwegian Sea.
—·—·— Average length + σ.
———— — —
- - - - - - — — — σ.
⊙ Maximum and minimum length.

Sei Whale.

Twin births are probably just as common in the sei whale as amongst blue whales and fin whales. Professor COLLETT in his book "Norway's Mammals" discusses several cases.

The material which I have here worked out, however, does not contain more than two cases of twin births.

$^{2}/_{5}$ 1925: 2 foetuses, 1260 mm. and 1100 mm. long
$^{29}/_{6}$ 1926: 2 — 1410 — — 1410 — —

Several years ago at one of the whaling stations in the Faroe Islands there was caught a female sei whale with 3 foetuses. The case was reported to me by the manager of the company concerned, but in this case also I am unable to give any details. However, there can be no doubt as to its accuracy.

VII.

The Whales' conditions of growth.

It appears from a previous section that at birth the blue whale has a length of about 26 feet (equals about 8100 mm.), whilst at birth the fin whale has a length of about 21 feet (equals 6500 mm.). This applies to the whales in the Southern Seas, whilst as I have previously pointed out it is my opinion that the length of newly born whales in the Northern Seas must be placed somewhat lower.

It will now be of interest to investigate whether the material to hand can provide any information as to how quickly growth takes place, in any case during the first part of the animal's period of growth.

In the first place I would call to mind what has been recorded regarding the gray whale in the previous section. It transpired from this information that at birth the gray whale had an average length of about 16 feet. By means of instances from Korea and Kamtchatka it was shewn that these young ones even after the course of half a year had reached a length of about 25 feet or even more. It was further shewn that the animals at the end of the first year of their life had attained a length of 30—32 feet, and that during the first year they had thus doubled their length at birth. These facts would appear to be unassailable.

It also appears probable that these conditions at least to a certain extent can be transferred to the larger species of whales.

Blue Whale.

In the whaling fields of the Southern Seas there are shot every year large or small quantities of comparatively small blue whales, animals about 40 feet in length to about 60 feet or somewhat more.

If we consider the measurements for, e. g. the season 1924—1925, it will be found that the following number of small blue whales were captured.

40 feet	0	males	1	females	=	1	animals
44 —	1	—	0	—	=	1	—
45 —	1	—	3	—	=	4	—
46 —	1	—	0	—	=	1	—
47 —	0	—	1	—	=	1	—
50 —	9	—	1	—	=	10	—
51 —	1	—	1	—	=	2	—
52 —	3	—	2	—	=	5	—
53 —	1	—	3	—	=	4	—
54 —	2	—	0	—	=	2	—
55 —	3	—	4	—	=	7	—
56 —	4	—	2	—	=	6	—
57 —	3	—	4	—	=	7	—
58 —	7	—	5	—	=	12	—
59 —	5	—	5	—	=	10	—
60 —	25	—	14	—	=	39	—
Total	66	males	46	females	=	112	animals

Of the total capture of 1563 males and 1298 females = 2861 animals.

These young animals occur considerably more frequently in the measurements from 60 feet up to about 65 feet.

These animals have a special characteristic. Norwegian whalers call them "myrbjönn" and there are even whalers who at first have been inclined to regard these animals as belonging to a special species. As, however, by degrees it has been observed that these animals are never found gestating, it was understood by the whalers that they were young blue whales, so much the more so because in a number of cases milk was found in the stomachs of smaller specimens.

These young animals may be met throughout the whole whaling season, but it is always found that the smallest specimens mainly occur at the beginning of the whaling season.

It is of course impossible to give an absolutely certain proof of the age of these animals, but on the other hand it is scarcely possible to conceive otherwise than that this is an animal in the first year of its life. There are, on the whole, a number of circumstances which appear definitely to indicate that the blue whale on an average acquires a length of about 60 feet in the course of the first year of its life, or that in the same period it at least doubles the length it had at birth.

What, however, is of the greatest interest to prove is the approximate age at which these animals reach puberty, and it is exactly in this connection that the "Discovery Expedition" will be able to procure the most valuable information. The material prepared by me gives no information regarding this, beyond the single fact as to the size of the animals which are found to be pregnant.

Table 48. Blue Whale Females.

Captured in the Southern Seas in the Seasons 1920—25.

Length norwegian feet 1 n.f. = 0,314 m.	Number of captured females	Number of pregnant females	% pregnant females	Length norwegian feet 1 n.f. = 0,314 m.	Number of captured females	Number of pregnant females	% pregnant females
40	1	—	—	Transport..	753	17	—
41	—	—	—	72	77	7	9,1 %
42	—	—	—	73	80	4	5,0 -
43	—	—	—	74	95	9	9,5 -
44	—	—	—	75	143	7	4,9 -
45	4	—	—	76	111	9	8,1 -
46	—	—	—	77	84	7	8,3 -
47	1	—	—	78	186	16	8,6 -
48	—	—	—	79	236	11	8,1 -
49	—	—	—	80	289	64	22,1 -
50	2	—	—	81	123	19	15,5 -
51	3	—	—	82	176	38	21,6 -
52	5	—	—	83	148	38	25,7 -
53	6	—	—	84	167	40	23,9 -
54	3	—	—	85	178	52	29,2 -
55	10	—	—	86	114	34	29,8 -
56	5	—	—	87	129	34	26,4 -
57	13	—	—	88	112	31	26,8 -
58	12	—	—	89	94	23	24,5 -
59	10	—	—	90	142	48	33,9 -
60	37	—	—	91	49	17	34,7 -
61	17	—	—	92	58	17	29,3 -
62	24	—	—	93	53	13	24,5 -
63	44	1	2,3 %	94	15	3	20,0 -
64	37	0	0	95	50	20	40,0 -
65	88	1	1,2 -	96	9	2	22,2 -
66	46	2	4,3 -	97	7	4	57,1 -
67	59	0	0	98	3	0	0 -
68	81	2	2,5 %	99	3	1	33,3 -
69	56	3	5,3 -	100	3	1	33,3 -
70	145	3	2,1 -	101	1	1	100,0 -
71	44	5	11,4 -		3688	587	—
	753	17	—				

These figures, however, are not without value. They shew that female blue whales under the length of 70 feet are very rarely found to be gestating, and practically never under the length of 65 feet. If we compare this fact with the above assumption that the blue whale during the first year of its life attains a length of about 60 feet, this would quite definitely appear to point in the direction of puberty beginning in these animals in the course of their second year.

Table 49. Blue Whale Females.

Captured at the fixed Stations for "Vestfold" and "Tönsberg Hvalfangeri", South Georgia 1920—25.

Length norwegian feet 1 n.f. = 0,314 m.	Number of captured females	Number of pregnant females	% pregnant females	Length norwegian feet 1 n.f. = 3,014 m.	Number of captured females	Number of pregnant females	% pregnant females
45	1	—	—	Transport..	475	12	—
46	—	—	—	74	35	5	14,3 %
47	1	—	—	75	64	3	4,7 -
48	—	—	—	76	21	3	14,3 -
49	—	—	—	77	31	4	12,9 -
50	1	—	—	78	26	5	19,2 -
51	2	—	—	79	27	2	7,4 -
52	3	—	—	80	55	13	23,6 -
53	1	—	—	81	42	11	26,2 -
54	3	—	—	82	38	16	42,1 -
55	5	—	—	83	46	15	32,6 -
56	2	—	—	84	54	15	27,8 -
57	8	—	—	85	72	24	33,3 -
58	9	—	—	86	41	15	36,6 -
59	8	—	—	87	57	14	24,6 -
60	21	—	—	88	64	20	31,3 -
61	13	—	—	89	53	12	22,6 -
62	14	—	—	90	83	28	33,7 -
63	24	—	—	91	35	12	31,4 -
64	22	—	—	92	33	8	24,2 -
65	62	—	—	93	37	10	27,0 -
66	29	—	—	94	14	3	21,4 -
67	39	—	—	95	35	13	37,1 -
68	38	1	2,6 %	96	4	1	25,0 -
69	20	—	—	97	5	1	20,0 -
70	72	2	2,8 %	98	1	—	—
71	21	4	19,0 -	99	1	—	—
72	33	3	9,1 -	100	—	—	—
73	23	2	8,7 -	101	1	1	100,0 %
	475	12	—		1450	266	—

I append a table which illustrates these conditions, and in it I have also calculated how large a percentage of the captured females were found to be gestating. It will appear from this table that the best period of conception of the blue whale does not occur before the animal has attained a size of 75 to 80 feet.

It likewise appears from the table that the female blue whale does not as a rule have young ones every year. This was previously the general assumption, especially as regards the humpback. According to the discoveries which our whalers

have now made, and from the statistical information now available, it appears to be quite certain that both the female blue whale and the fin whale as a rule only have young ones every other year. I have not been able to find any exception from this rule. As I have already mentioned, I am aware of only one case in which a humpback in the first period of pregnancy was accompanied by a suckling.

The tables here appended speak for themselves, and I see no reason to give a further explanation of them.

One remark, however, concerning the material upon which these tables are based must be made.

It will be noticed that in the table from South Georgia there occurs only one pregnant female under 70 feet in length, one specimen of 68 feet. In the table which comprises the whole catch of the Southern Seas — South Georgia, South Shetlands and South Orkneys — there occur, however, 9 specimens of gestating females under 70 feet in length, but of these only one 63 feet in length. These animals were thus measured at South Shetlands and South Orkneys, where floating factories are almost exclusively used. As I have previously remarked, there are difficulties connected with making exact measurements at these floating stations, difficulties which do not occur at the land stations. The animals are measured at the floating factories when lying in the water along the side of the ship. The whale is therefore measured with less exactitude, in many cases is even measured only approximately. Thus it occurs year after year that the size of a whale, especially in the case of some of these floating stations, appears to be under-estimated. I therefore consider that these measurements of gestating females under 70 feet are not exact enough. If the measurements are made exactly it will doubtless be found that gestating blue whales only quite exceptionally occur under 70 feet in length. The same also applies to the measurements of fin whales, as these are represented in the following tables.

The measurements from South Georgia shew that the smallest gestating fin whales which were caught had a size of 62 feet. I have, however, other figures from South Georgia which are not included here which shew that a gestating female whale 58 feet in length was caught (April 24th 1926). The figures from South Shetlands and South Orkneys, however, have 6 measurements under 58 feet. I am inclined to believe that these were not measured exactly and were under-estimated. If the fin whale measurements in the Southern Seas are carried out exactly it would doubtless be found that gestating fin whales below the length of 60 feet only occur quite exceptionally.

Fin Whales.

In the whaling fields of the Southern Seas there are also caught every year a number of fin whales ranging in size from 40 feet to 55 feet. If we consider the

Table 50. Fin Whale Females.

Captured in the Southern Seas in the Seasons 1920—25.

Length norwegian feet 1 n.f. = 0,314 m.	Number of captured females	Number of pregnant females	% pregnant females	Length norwegian feet 1 n.f. = 0,314 m.	Number of captured females	Number of pregnant females	% pregnant females
35	1	—	—	Transport . .	761	37	—
39	1	—	—	64	126	19	15,1 %
40	3	—	—	65	174	9	5,2 -
41	2	—	—	66	107	18	16,8 -
42	3	—	—	67	147	15	10,2 -
43	1	—	—	68	225	26	11,5 -
44	3	—	—	69	141	27	19,1 -
45	6	—	—	70	368	88	23,9 -
46	3	—	—	71	112	17	15,2 -
47	4	—	—	72	141	33	23,4 -
48	8	—	—	73	120	26	21,7 -
49	7	—	—	74	93	22	23,7 -
50	22	—	—	75	128	34	26,6 -
51	12	—	—	76	80	22	27,5 -
52	35	—	—	77	41	15	35,9 -
53	12	1	8,3 %	78	66	21	31,8 -
54	28	—	—	79	32	10	31,3 -
55	29	1	3,4 %	80	33	11	33,3 -
56	30	4	13,3 -	81	6	—	—
57	38	—	—	82	7	4	57,1 %
58	62	6	9,7 %	83	8	2	25,0 -
59	50	—	—	84	1	—	—
60	145	6	4,1 %	85	1	—	—
61	48	2	4,2 -	87	1	—	—
62	102	9	8,8 -	89	1	1	100,0 %
63	106	8	7,5 -		2920	457	—
	761	37	—				

measurements, e. g. for the season 1924—1925, we shall also find here that the following number of these small fin whales were captured.

40	feet	0	males	1	females	=	1	animals
42	—	1	—	0	—	=	1	—
43	—	4	—	0	—	=	4	—
44	—	1	—	1	—	=	2	—
45	—	2	—	1	—	=	3	—
46	—	2	—	1	—	=	3	—
47	—	0	—	1	—	=	1	—
48	—	3	—	3	—	=	6	—
Carry forward		13	males	8	females	=	21	animals

Brought forward	13	males	8	females	=	21	animals
49	— 2	—	2	—	=	4	—
50	— 10	—	6	—	=	16	—
51	— 3	—	1	—	=	4	—
52	— 5	—	8	—	=	13	—
53	— 7	—	1	—	=	8	—
54	— 11	—	8	—	=	19	—
55	— 16	—	10	—	=	26	—
Total	67	males	44	females	=	111	animals

of a total catch of 1512 males and 1129 females = 2641 animals.

Table 51. Fin Whale Females.

Captured at the fixed Stations for "Vestfold" and "Tønsberg Hvalfangeri", South Georgia 1920—25.

Length norwegian feet 1 n.f. = 0,314 m.	Number of captured females	Number of pregnant females	% pregnant females	Length norwegian feet 1 n.f. = 0,314 m.	Number of captured females	Number of pregnant females	% pregnant females
40	1	—	—	Transport..	187	10	—
41	1	—	—	65	35	3	8,6 %
42	1	—	—	66	15	4	26,7 -
43	—	—	—	67	40	4	10,0 -
44	2	—	—	68	41	7	17,1 -
45	—	—	—	69	31	17	54,8 -
46	2	—	—	70	80	19	23,8 -
47	2	—	—	71	38	10	26,3 -
48	1	—	—	72	53	17	32,1 -
49	—	—	—	73	41	12	29,3 -
50	5	—	—	74	32	11	34,4 -
51	2	—	—	75	87	24	27,6 -
52	9	—	—	76	46	14	30,4 -
53	3	—	—	77	28	12	42,9 -
54	4	—	—	78	45	16	35,5 -
55	7	—	—	79	22	7	31,8 -
56	4	—	—	80	23	10	43,5 -
57	14	—	—	81	4	—	—
58	10	—	—	82	2	1	50,0 %
59	8	—	—	83	3	1	33,3 -
60	29	—	—	84	1	—	—
61	13	—	—	85	1	—	—
62	18	2	11,1 %	87	—	—	—
63	30	3	10,0 -	89	1	1	100,0 %
64	21	5	23,8 -		856	200	—
	187	10	—				

These animals are undoubtedly all young whales. If we assume an average size for the fin whale at birth of about 21 feet and that, like the gray whale it practically doubles its length in the course of the first year of its life, we arrive at the assumption that the fin whale of the Southern Seas in the course of the first year of its life attains a size of 50 feet, a growth which for some time after appears to continue at a comparatively rapid rate.

Regarding the size at which the fin whale is found to be pregnant I would refer to the following tables, which, however, in every respect speak for themselves.

It appears from the tables that the fin whales best period for conception occurs when it has attained a length of about 65 feet.

In conjunction with these figures regarding the conditions of pregnancy of the fin whale of the Southern Seas, I also give a table regarding the corresponding conditions in the fin whale of the Northern Seas. These figures, which have been obtained from all the whaling fields in the Northern Seas, are of recent date, and were sent to the Norwegian Whalers' Association by the managers of the various expeditions. They must all be assumed to be very exact as, with one exception, they were made at permanent stations, and in other respects under conditions where there has been ample time to undertake the necessary measurements.

I would point out that pregnancy appears to occur in fin whales of the Northern Seas as early as when they attain a size of 55 feet. It is true that in the table appended there is only one case in which this is proved, but I have in my material from the summer of 1926, which has not yet been so worked out that it can be used in the present publication, a number of measurements from Kamtchatka, in which for the month of September there are three measurements of gestating fin whales 56 feet in length, and with fetuses from 7—9 feet in length.

This moreover agrees quite well with the conditions of growth of these whales, in that the animals as already remarked never attain the size of those in the Southern Seas. It is also on this basis that I have ventured to assume that the newly born fin whales of the Northern Seas scarcely have the size of the average fin whales born in the Southern Seas.

The following table shews parallel conditions with those already submitted for the Southern Seas.

Table 52. Fin Whale Females.

Captured in the Norwegian Sea.

Length norwegian feet 1 n.f. = 0.314 m.	Number of captured females	Number of pregnant females	% pregnant females	Length norwegian feet 1 n.f. = 0,314 m.	Number of captured females	Number of pregnant females	% pregnant females
36	1	—	—	Transport . .	158	1	—
39	1	—	—	58	30	1	3,3 %
40	3	—	—	59	16	2	12,5 -
41	1	—	—	60	43	6	14,0 -
42	1	—	—	61	24	3	12,5 -
43	1	—	—	62	38	8	21,1 -
44	3	—	—	63	30	7	23,3 -
45	2	—	—	64	39	15	38,5 -
46	1	—	—	65	43	11	25,6 -
47	3	—	—	66	33	14	42,3 -
48	5	—	—	67	30	12	40,0 -
49	4	—	—	68	41	12	29,2 -
50	8	—	—	69	24	8	33,3 -
51	12	—	—	70	47	14	29,8 -
52	16	—	—	71	16	5	31,3 -
53	18	—	—	72	7	3	42,9 -
54	14	—	—	73	8	6	75,0 -
55	26	1	3,8 %	74	2	—	—
56	21	—	—	75	3	2	66,7 %
57	17	—	—		632	130	
	158	1	—				